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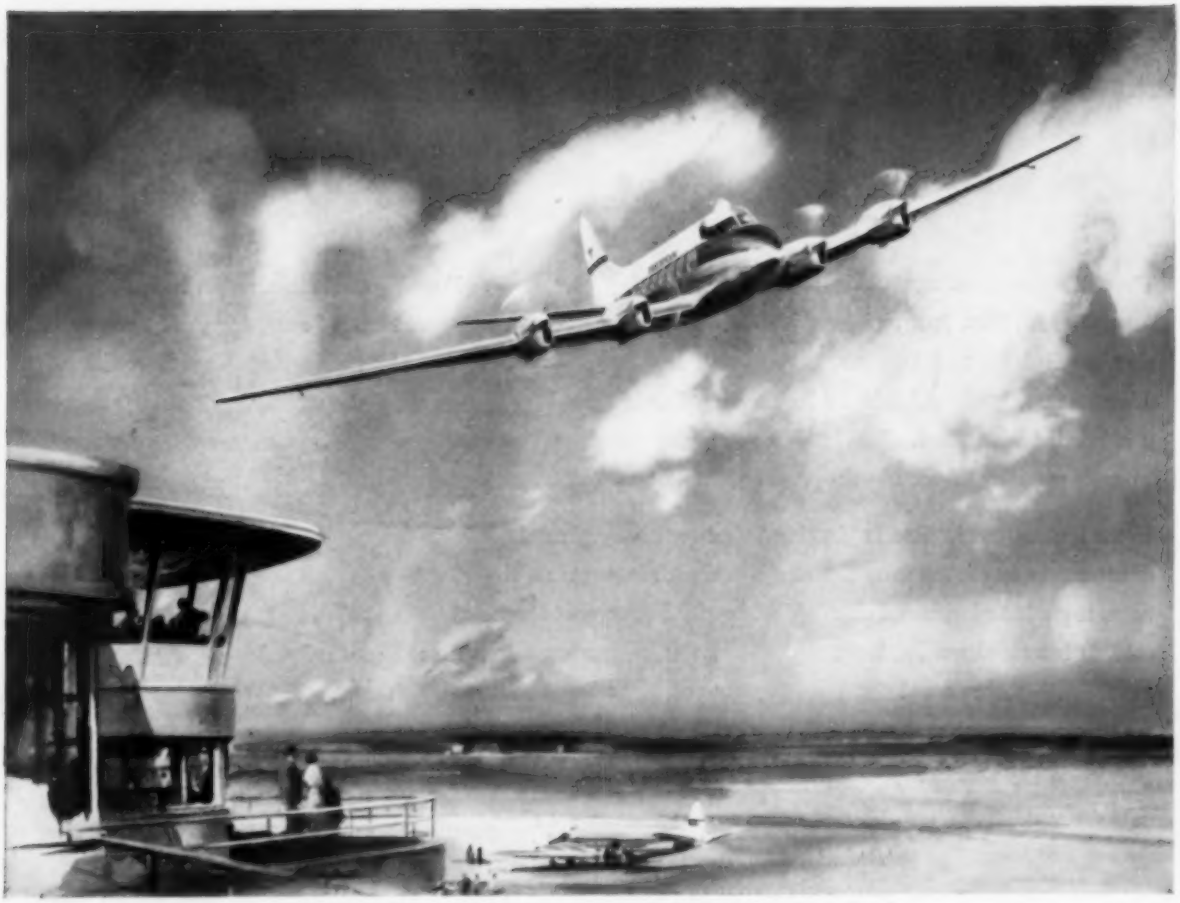

The Heron, for either 14- to 17-passenger feeder service or executive duty, has been ordered by about 20 countries

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In the last ten years, 'Redux' has been used for bonding metal structures in more than forty different machines, ranging from airliners to guided missiles and often operating under extremes of heat and cold. It has saved weight, lowered production costs, increased resistance to fatigue—these are known advantages of adhesive bonding which are influencing the design of new machines.

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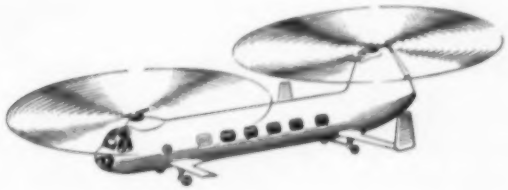

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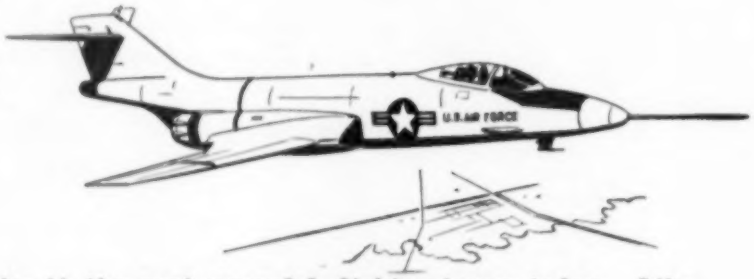
UNITED AIRCRAFT EXPORT CORPORATION

BRITISH ENGINEERS HONOR IGOR SIKORSKY

Aeronautical pioneer Igor I. Sikorsky, Engineering Manager of Sikorsky Aircraft, has been named to receive the 1955 James Watt International Medal, one of the world's top honors in mechanical engineering. The British Institution of Mechanical Engineers makes the award every two years on the birthday anniversary of James Watt, inventor of the steam engine. The citation declares the award was made in recognition of Mr. Sikorsky's life work in applying science to the progress of mechanical engineering, through his pioneering development of aircraft of various types, multi-engined amphibians and particularly helicopters.

MOST POWERFUL FIGHTER-BOMBER UNVEILED BY U.S. AIR FORCE

America's most powerful fighter-bomber, the McDonnell F-101 Voodoo, has been unveiled by the U. S. Air Force. The Voodoo was designed to meet Air Force needs for a long-range fighter. It is being produced in St. Louis, Missouri, and is scheduled to be assigned to the Strategic Air Command within the Air Force. The big fighter is the third new Air Force jet fighter model to be powered by Pratt & Whitney Aircraft's J-57 turbojet engine.



The Voodoo is the first fighter-type aircraft to have two J-57s. These engines are fitted with special afterburners which are about two feet shorter than standard afterburners for the J-57. This power plant equipment gives the Voodoo well over 20,000 pounds of thrust, to make it the most powerful fighter known today. Like other supersonic Air Force and Navy aircraft built around the J-57 engine, the McDonnell F-101 is designed to take full advantage of the outstanding fuel economy and tremendous thrust of its twin J-57s.

Wing span is 39 feet. Length is 67 feet. The F-101 is in the supersonic speed class, and is able to carry atomic weapons. The big aircraft is now being test flown at the Edwards Flight Test Center in California.

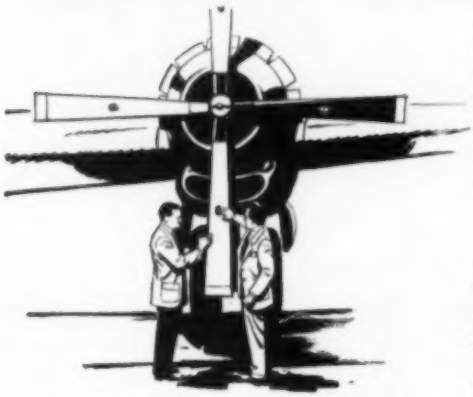
Other new jet fighters powered by Pratt & Whitney Aircraft's 10,000-pound thrust class J-57 turbojets are the North American F-100 Super Sabre and the Convair F-102 interceptor, both Air Force planes, and the Navy's Douglas F4D Skyray carrier-based interceptor-fighter.

HAMILTON STANDARD PNEUMATIC STARTERS BUILT FOR VOODOO FIGHTERS

Lightweight pneumatic jet engine starters, designed and built by Hamilton Standard, are being furnished to the U. S. Air Force for installation on McDonnell F-101 Voodoo fighter-bombers. These starters deliver over 100 horsepower and yet weigh far less than electric starters of equal power.

Hamilton Standard's pneumatic starter harnesses a jet stream of compressed air with a 7-inch turbine wheel which spins up to 45,000 revolutions per minute. It operates equally well on compressor bleed air as high as 700°F, or on air from an external source.

PROPELLER LIFE EXTENDED BY NEW HAMILTON STANDARD PROCESS



A process to make hollow steel propeller blades highly resistant to damage by loose stones or other debris drawn into the propeller disk during takeoffs or other ground operations, has been announced by Hamilton Standard. The development involves an armor coating of nickel over a zinc and copper base.

The nickel-plated blades already have been adopted for service by two major airlines and the air forces of three countries. Test and service records show that blades protected by the new process have a greater service life, greater safety, and require less maintenance.

Hamilton Standard first disclosed its work with the special armor coating about two years ago. Prior to flight testing, blades treated by the process were put through hundreds of hours of grueling punishment. Plated and unplated blades, revolving at takeoff speeds, were bombarded with small stones. They were even targets for glass missiles fired from shotguns. These tests, plus nearly 750,000 hours of subsequent flight service testing, proved the effectiveness of the new nickel plating process.

NEW FLOAT-TYPE LANDING GEAR EXTENDS WORK OF S-55 HELICOPTERS

Use of commercial Sikorsky S-55 helicopters to transport oil well drilling crews to and from their jobs offshore in the Gulf of Mexico, is now being expanded with the development of new flotation landing gear for the S-55. The gear is approved by the Civil Aeronautics Administration, an agency of the U. S. government. It permits the big S-55s to land safely on water or marshland, as well as on their regular heliports, on barges, tenders or platforms at sea.

The flotation gear is available to replace the four fixed landing wheels usually installed on S-55s. Weight of this installation is about the same as that of standard wheels and struts.

Sikorsky Aircraft pioneered with flotation gear on helicopters as early as 1940. The world's first helicopter landings and takeoffs from water were made in the historic VS-300 equipped with floats.

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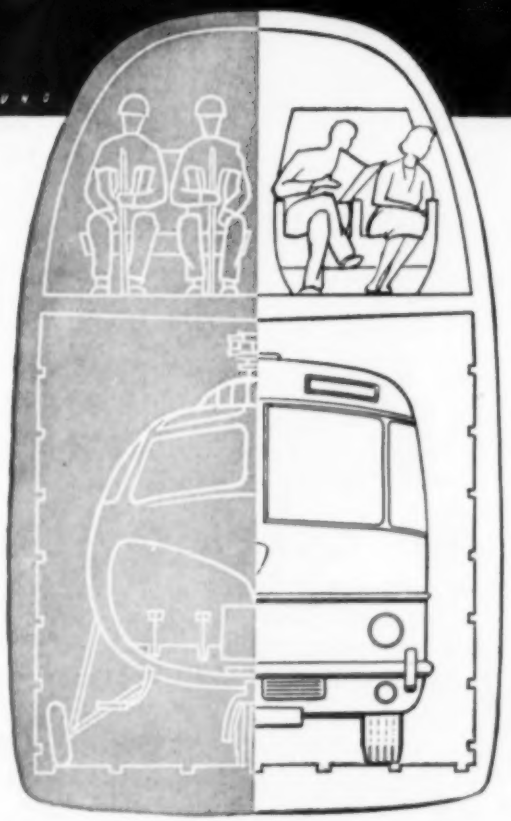

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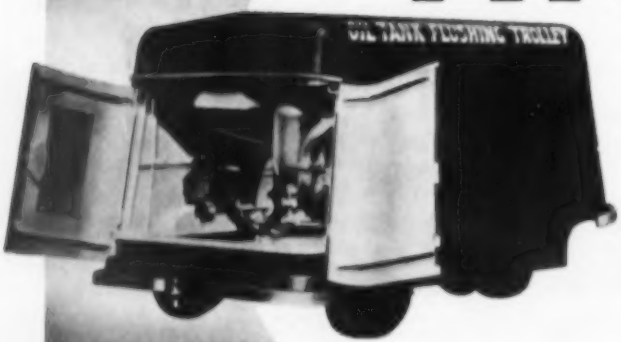

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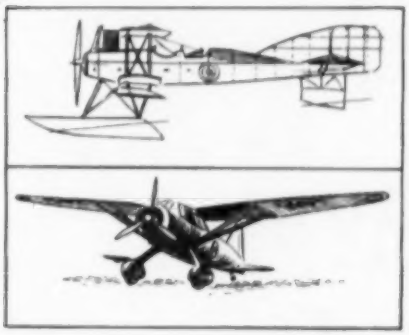

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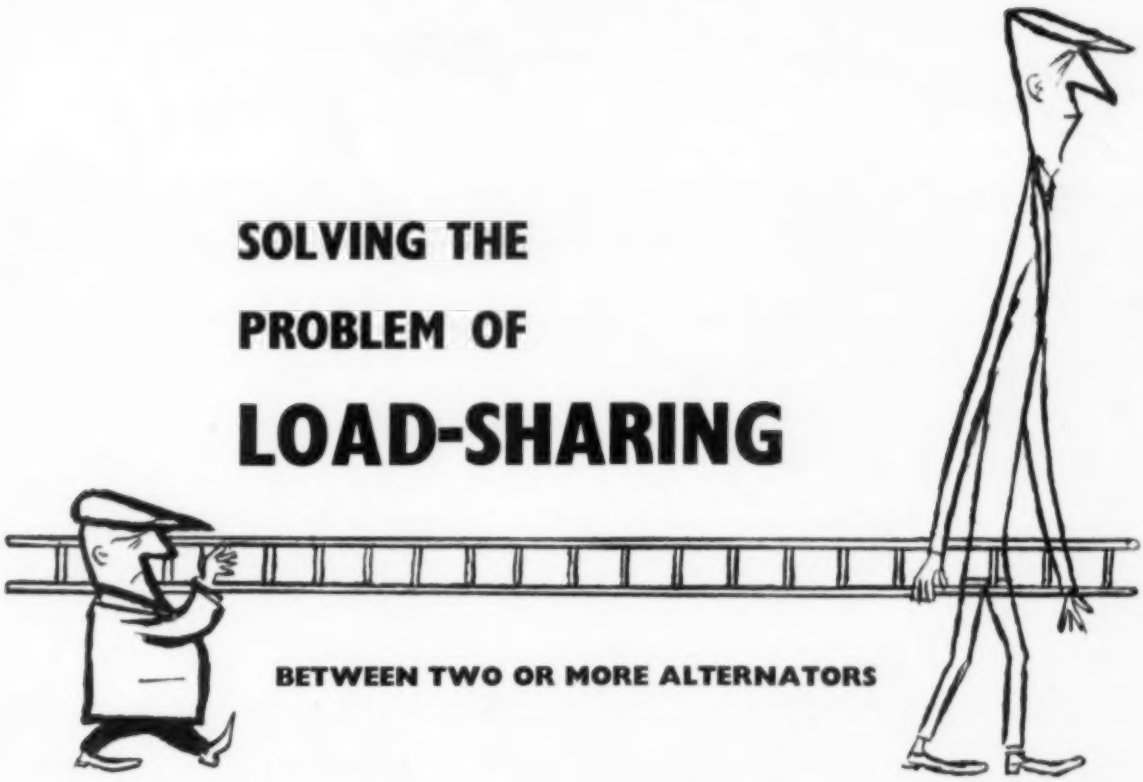

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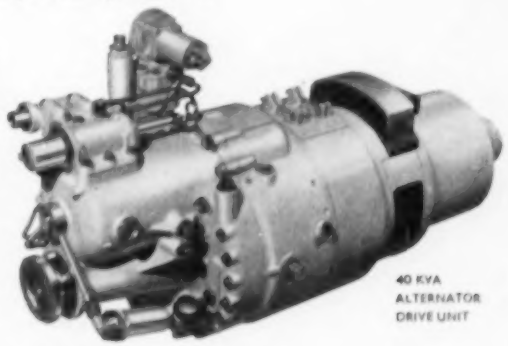

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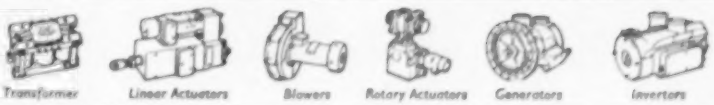

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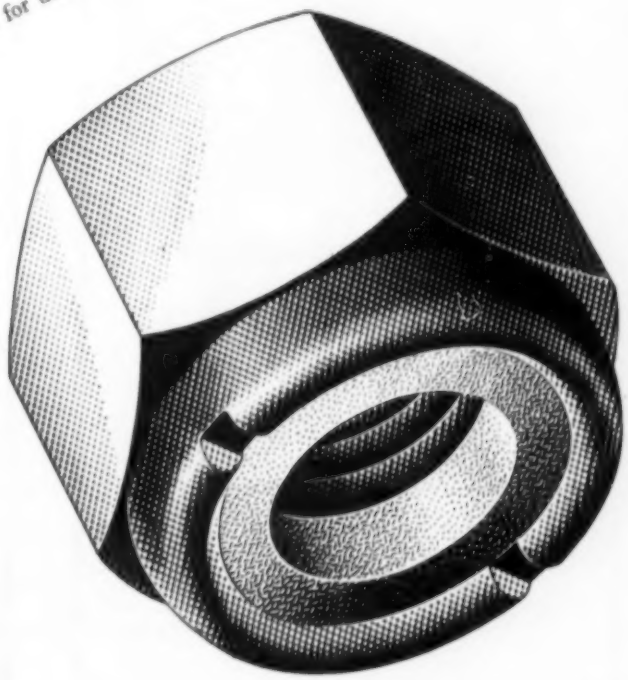

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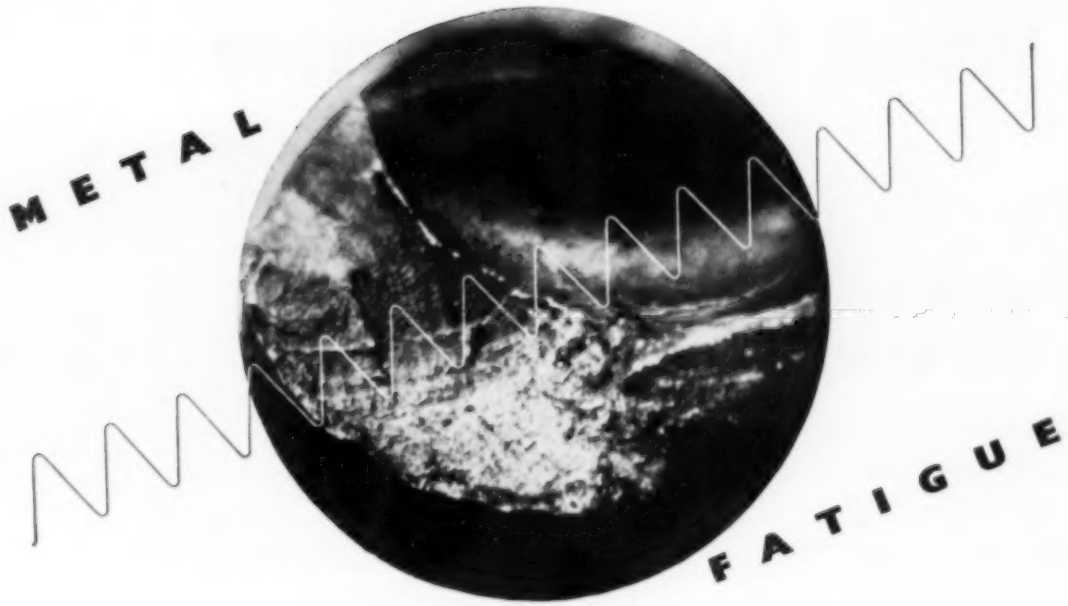

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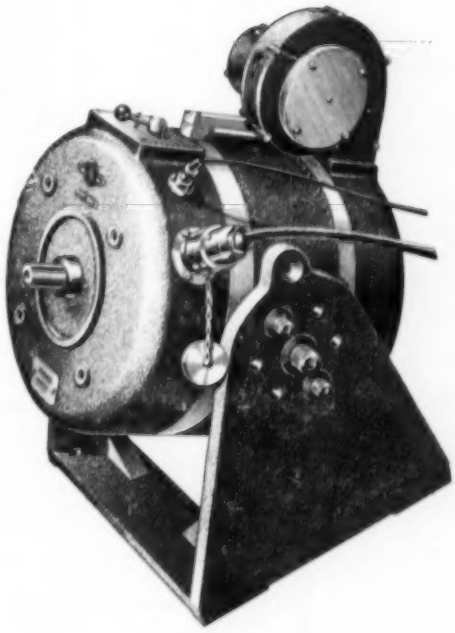

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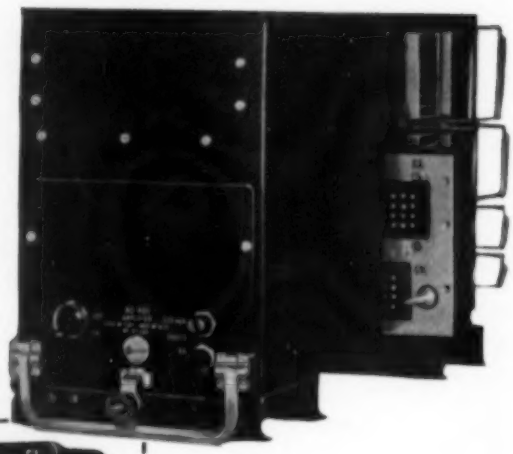

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One Aim, One Shot

THOSE who are privileged to move freely around the British aircraft industry and to meet its members at the many technical and social functions naturally learn something of the thoughts and aspirations of both individuals and companies. As a result, it is often possible to discover, or at least sense, underlying trends of thought in addition to the obvious expressions of interest in purely topical events. Recently, for example, we have gained the impression that several designers are having quiet but very serious second, or probably third, thoughts about the speeding-up of development and deliveries of new aircraft. It is now some time since such matters were considered to be headline news of wide public concern, but the problems themselves are still very much extant, though perhaps slightly differently integrated.

At one period there was loud bandying of words over muddle and procrastination in the specifying, ordering and developing of aircraft; but this, quite rightly, has now sunk to no more than a murmur. Instead, more mature thoughts have turned to the question of making the best possible use of available resources—men, money and materials—and likewise of the still limited research facilities now that aircraft orders have been placed and targets set.

Action is also being taken further to streamline the processes of development and to improve personal relationships and those between departments, in order to avoid duplication and to achieve the maximum of co-operation.

More than a hint of such measures crystallized in the speeches—summarized on page 475—at the recent Contractors' Dinner at Boscombe Down. Sir Sydney Camm stated bluntly that the time involved in Service re-equipment must be shortened; and by quoting a famous passage from Macaulay's *Horatius* he gave some clue to the differences of opinion which still exist.

No one could be more concerned with the provision of military aircraft than Air Chief Marshal Sir John Baker; without taking it as the theme of his speech, he nevertheless made clear his anxiety that the Ministry of Supply should play its part in smoothing the way between the designer's office and the squadron. Both these speeches followed that of the Air Officer Commanding, Boscombe Down, who closed his engaging address to the manufacturers with the words: "We, like you, only want the Services to have the best possible equipment in the shortest possible time."

The Cost of Mistakes

Indicative of the trend of thoughts of a chief designer were the remarks of Mr. S. D. Davies, of Manchester, who was the fourth speaker at Boscombe. He stated quite plainly that the rate of technical development was increasing so fast that the only hope of producing aircraft quickly was to get them right first time. He might have added that delays through mistakes must in future be expected to put the aircraft concerned completely out of the running; and this is something that neither a company nor the country can afford, metaphorically or literally. Truly, if we may be forgiven the parody, the path of aircraft evolution is strewn with good near-misses.

To certain problems it is hard for manufacturers to find solutions. Competition for the available manpower in various categories is having its effect on production schedules; some suppliers of equipment have begun to suffer in this way. Much valuable time has been lost through minor industrial disputes, and deliveries to meet more than one of the most important overseas orders have been jeopardized.

Fortunately, the chances are improving of getting aircraft right first time, in spite of their growing complexity. Thanks for this must be given to such elaborate, costly yet essential research facilities as that described by the Controller of Aircraft as "the new Farnborough at Bedford," and to the increasing availability and employment of electronic computors. Although knowledge and experience are building up rapidly we have little doubt that the success of the British aircraft industry in meeting its national commitments, and in facing powerful competition from overseas, will depend increasingly upon the additional answers its relatively few human brains are able to coax from their new electronic counterparts.

FROM ALL QUARTERS

New Supply Minister

FOLLOWING the retirement of Sir Winston Churchill, a number of Cabinet changes were announced on the eve of the Easter recess. Among them was the appointment of Mr. Reginald Maudling as Minister of Supply in succession to Mr. Selwyn Lloyd, who in turn succeeds Mr. Harold Macmillan (appointed Foreign Secretary) as Minister of Defence. Mr. Maudling was formerly Economic Secretary to the Treasury.

Mr. F. J. Erroll is appointed Parliamentary Secretary to the Ministry of Supply.

Further reference to these changes will be made in our next issue.

Air-to-air Atomics

A NUCLEAR weapon exploded over the Nevada Desert on April 6th was intended to simulate the effect of a guided missile fired into a bomber formation by a defending aircraft.

Said to have been six feet long, and apparently rocket propelled and electronically guided, it was released from an aircraft and directed towards a target consisting of a smoke-trail pattern previously laid by jet aircraft.

The missile exploded, reportedly above this target, "with a blinding orange and white flash." The usual mushroom-shaped cloud was absent; instead, there was a gigantic smoke-ring which hung in the sky for twelve minutes.

Dramatic Helicopter Rescue

ONCE again the efficiency of the rotating-wing aircraft as a lifeboat was demonstrated when, on Saturday last, a Dragonfly from R.N.A.S. Ford effected a series of rescues from a yacht in distress a mile off Worthing, Sussex. Four of the vessel's crew—which consisted of a man, two women and three children—were taken from the water by the aircraft, which made four trips between ship and shore. One of the children was picked up by the new scoop-net device—the second time in a month that it has been thus effectively used. The pilot was Lt. J. Walden.

The remaining two members of the yacht's crew—the man and one of the children, a boy—were rescued by boat after the helicopter had been disabled through its tail rotor striking an onlooker on the beach. The onlooker, a youth, was killed.

B.O.A.C.'s Easter Egg

DESPITE the setbacks which afflicted B.O.A.C. during the financial year 1954-55, the Corporation achieved a profit of approximately £1,360,000 and a net surplus—after payment of interest on capital—of £260,000. This encouraging news was given by the chairman, Sir Miles Thomas, on April 4th, in a message to employees. Adding that in recent weeks the "forward fleet pattern has clarified almost dramatically," Sir Miles outlined B.O.A.C.'s plans for operating Britannias, Comets and DC-7Cs:

"Firstly, the Comet situation has been settled in what I regard as a most satisfactory way. Technical advances made by Rolls-Royce to the Avon engine by what amounts in effect to raising the compression, and developments in the structural design of the airframe by de Havillands, have resulted in the evolution of a Mk 4 design of Comet. The engines have 500 lb more thrust and 9 per cent better specific fuel consumption and this, with the increased pod tankage, more than counterbalances the extra weight that will be built into the airframe to increase its strength.

"The outcome is an aeroplane of longer range, better economics and still greater passenger attraction. The "droop snoot" leading edge on the wings and the larger flaps improve its handling characteristics both at take-off and landing. In other words, there are distinct credits to offset the time lost as between the Comet 1, and delivery of the Mark 4 towards the end of 1958.

"To expedite the entry of these aircraft into our fleets when they begin to be delivered from the factories in 1958, we are taking the Mark 2 airframe with the new engines and built structurally to the new standards for crew familiarization and the accumulation of engine hours.

"The contract for the ten Douglas Seven Seas has been signed, a fleet nucleus is being formed under the management of Captain M. J. R. Alderson, and arrangements are well in hand for these aircraft to be available for use on our transatlantic services early in 1957, thus securing our competitive situation.

"The Britannia Mk 100 has done very well on her African trials. The recorded performance figures are very encouraging. Our aircrew and observers report well on her high-altitude performance at Johannesburg and tropical trials at Khartoum. There is a good backing of production effort in the Bristol factory. We hope to be able to introduce the Britannia Mk 100 into service next year, first on the South African route and subsequently on the Australian and Far East routes.

"Progress with the Mk 300 and the Long Range Mk 300 Britannia continues to be encouraging, and they can be expected to reproduce the attractive operational characteristics that the Mk 100 is demonstrating on her tests."

The message paid tribute to the way in which the Argonaut Fleet have "held the fort" during the past 12 months, noting that in 1954-55 their aircraft achieved a daily utilization of 9.4 hr.

THE MASTER PILOT: This officer could plot a course better than the best and fly it with something more than skill. He inspired by example and reassured by devotion. His log is no bare record but a noble work. As he goes off duty and steps aft we wish him ease.

Sir James Barnes Retiring

IT has been announced that Sir James Barnes, K.C.B., K.B.E., Permanent Under-Secretary of State to the Air Ministry, is retiring from the public service at the end of June. He is to be succeeded by Sir Maurice Dean, K.C.M.G., C.B., who is at present a Second Secretary to the Board of Trade.

When he retires, Sir James Barnes will have spent 36 years at the Air Ministry; he joined the department in 1919, a little over a year after its inception. During this period he has worked closely with every Chief of the Air Staff.

Born in 1891 and educated at Manchester Grammar School and Merton College, Oxford, Sir James was appointed Director of Civil Aviation Finance in 1937, and Deputy Director-General of Civil Aviation in 1940. He became Assistant Under-Secretary of State for Air in 1941, and Deputy Under-Secretary in 1943. He is one of only three civilians ever to be admitted to membership of the Royal Air Force Club, having been accorded this distinction in 1947 in recognition of his valuable services to the R.A.F.

Although now with the Board of Trade, as mentioned above, Sir Maurice Dean is no stranger to the Air Ministry. He joined it in 1929 as an assistant principal on his entry to the Civil Service and remained in the department until 1946. His association with Air Staff matters began in 1934 when he was made private secretary to the C.A.S. Two years later he became head of the Air Staff Secretariat and held this post until he was promoted to Assistant Under-Secretary of State in 1943. In 1946 he left the

DEPARTMENTAL DRESS: Delivered at the end of March to the Canadian Department of Transport, this Viscount features an unusual and effective colour-scheme. Details of its ferry flight are given opposite.

Air Ministry and held a succession of senior posts in various ministries. He was knighted in 1949. Sir Maurice, who is now 48 years of age, was educated at St. Olave's School and Trinity College, Cambridge.

Byrd for the Antarctic

TWENTY-SIX years since his first flight over the South Pole, Rear Admiral Byrd is to lead another expedition to the Antarctic next year—his fifth trip to those regions. Organized by the U.S. Navy, the expedition will leave the U.S.A. next November. It will be composed of 1,250 men, 14 aircraft of various types (these will operate from New Zealand), and five ships—two ice-breakers, two cargo ships and a fleet oiler.

A New Department at Cranfield

A NEW department—to be known as the Department of Aircraft Electrical Engineering—has been created at the College of Aeronautics, Cranfield, and Mr. G. A. Whitfield, B.Sc., has been appointed as its Professor and Head; he will take up his duties on June 1st. The appointment is in fulfilment of the governors' policy of expanding the electrical section of the Department of Aircraft Design into a full teaching department.

Mr. Whitfield, who graduated with special honours in physics at Sheffield University, is at present Head of the Controlled Weapons Division in the Armament Department at the R.A.E., Farnborough, and has held the rank of senior principal scientific officer since 1951.

Viscount Ferry Record

IMPRESSIVE flight times were achieved by the Canadian Department of Transport Viscount, CF-GXK, on its recent delivery flight from Wisley to Montreal *via* Prestwick, Keflavik and Bluie West One. Favourable winds enabled Vickers-Armstrongs' chief test pilot, "Jock" Bryce, who was in command, to fly direct from Bluie West to Montreal without making the usual refuelling stop at Goose Bay, Labrador. This 1,600-mile stage was covered at an average ground-speed of 345 m.p.h.

Between Bluie West One and Goose Bay the tail-wind component was some 3 m.p.h., giving a ground-speed of 335 m.p.h. Arriving over Goose, Bryce decided to continue direct to Montreal, and on this 825-mile leg a 30-m.p.h. tail component brought the ground-speed to 360 m.p.h. This final part of the journey took 2 hr 18 min—an unofficial record; previously, Viscounts had stopped to refuel at Goose Bay, and the best time achieved was 3 hr. Total Atlantic flying time of the D. o. T. Viscount on its 3,338-mile journey from Prestwick to Montreal was 11 hr 6 min.

In addition to Mr. Bryce, the aircraft carried Mr. W. Gadsoz of the D. o. T. (co-pilot); Mr. D. L. Jones and Mr. C. N. Scott (navigators); and Mr. R. Pullin (flight engineer). Mr. Gadsoz is at present attending the Empire Test Pilots' course at Farnborough. As reported elsewhere in this issue, CF-GXK will initially be used for the training of Canadian Viscount pilots, under an agreement between T.C.A. and the D. o. T.

The "Dam Busters" Film

INDICATIVE of the hold which No. 617 Squadron's operations against the German dams still retains on the public imagination is the news that the world première of *The Dam-Busters* film was "sold out" almost as soon as the date was announced.

Organized jointly by the Pathfinder Association and the R.A.F.A. the première has been arranged for Monday, May 16th, and H.R.H. Princess Margaret has graciously consented to attend. All the seats, priced at from 5s to 5 gns, were sold within 24 hours of the announcement, so the possibly unprecedented step was taken of arranging a second première for the following night, May 17th. Seats for this second night have been selling almost as fast, but a few at prices from 5s to 3 gns remain as we go to press; a telephone call to the Première Hon. Secretary, R.A.F.A., at Langham 8181 or 8187 (night) might be worth while.

There will not, of course, be royal attendance on the second night, but a number of R.A.F. senior officers and other notabilities will be present. On both evenings there will be a stage presentation in which will appear Miss Gladys Ripley, the famous contralto; the R.A.F. Association Mixed Choirs; and the R.A.F. Central Band under W/C. Sims.

We understand that the film interests concerned have been particularly helpful in the arrangements for the two shows and that a number of their members who themselves served in the R.A.F. have done a great deal to forward the preparations. The proceeds of the premières will go to the R.A.F.A., R.A.F. Benevolent Fund, the Pathfinder Association and the R.A.F. Escaping Society.

In the film—made by Associated British Picture Corporation from a script prepared by R. C. Sheriff from Paul Brickhill's book—Guy Gibson is portrayed by Richard Todd, "Mutt" Summers by Patrick Barr and Dr. B. N. Wallis by Michael Redgrave. The sequences showing the training for the attack on the dams were made at Windermere with the help of R.A.F. crews flying recommissioned Lancasters. The major part of the location work was done at Scampton—the station from which No. 617 Sqn actually took off on the famous raid. Photographs taken at Scampton and elsewhere during the making of the film were reproduced in *Flight* of June 18th, 1954.

***ASSAYED:** The spoil-heaps of a gold mine give a clue to the location in this new picture of Bristol Britannia G-ANBA, which began its successful tropical tests in Johannesburg and has now concluded them at Khartoum. It was due to return on Wednesday.*

Renfrew Developments

LITTLE or no redundancy should result from the closing-down of B.E.A.'s maintenance base at Renfrew, according to a statement in the House of Commons on April 6th by Mr. J. Boyd-Carpenter, Minister of Transport and Civil Aviation. The Minister said that, in the circumstances, he no longer felt justified in pressing B.E.A. to continue operation of the base.

The Canadian Government was placing a contract with Scottish Aviation, Ltd., for repair and overhaul of Sabres at Renfrew, and this was expected to provide employment for some 300 engineers.

Lord Douglas, B.E.A.'s chairman, has said that another 100 would be needed for servicing of B.E.A. aircraft at Renfrew, and that expansion of the Corporation's operations at London Airport would create up to 300 vacancies for skilled engineers and associated staff.

National Air Race Entries

THE Royal Aero Club has announced the entries for the first meeting in the 1955 National Air Races series, to be held at Fairwood Common, Swansea, on April 30th. This year's series of four meetings, it will be remembered, is based on a progressive points system covering six classes, and a seventh has now been added—for the Goodyear Challenge Cup (and prize money), open to Miles Gemini owners.

A novel entry in the Grosvenor Cup class (aircraft capable of up to 130 m.p.h.) is an Agusta-Bell 47G helicopter. The entry list is as follows:—

S.B.A.C. Cup Class.—G. Marler (Falcon Six), R. R. Paine (Hawk S. Six)—(Mew Gull entered by F. Dunkerley), F. Dunkerley (Sparrowjet).

Goodyear Trophy Class (for Gemini aircraft).—P. Blamire (Gemini 1a), F. Dunkerley (Gemini 1a), J. N. Somers (Gemini 2).

Air League Cup Class (for Proctor aircraft).—E. Noel Husbands (Proctor 1), T. G. Knox (Proctor 3).

Kemsley Trophy Class.—A. J. Spiller (Messenger 2a), D. F. Ogilvy (Gomper Swift), J. R. Johnston (Hawk Trainer 3), C. G. Wheatley (Globe Swift), J. N. Somers (Chipmunk), J. de Luigi (Ambrosini S.1001).

Norton Griffiths Trophy Class (for Tiger Moths).—B. J. Snook, B. Maile, P. Vanneck, J. H. Denyer, J. M. Donald.

Grosvenor Cup Class.—J. Crewdson (Agusta-Bell 47G), Miss F. M. Leaf (Tipsy Trainer 1), C. Gregory (Taylorcraft Plus D),—(G. A. Cygnet entered by R. Lamprell), D. Westoby (Aiglet J. 5K).

"FLIGHT" STAFF APPOINTMENTS

The following appointments on the editorial staff are announced:—

H. F. ("Rex") King, M.B.E. (who has been assistant editor since May 1949), associate editor.

W. T. ("Bill") Gunston, technical editor.

Roy Casey, production editor.

VISITING THE VICTOR: The Handley Page Victor, subject of these new "Flight" photographs, has lately been sampled by various distinguished visitors. Details in an item ("High Authority") below.

FROM ALL QUARTERS . . .

Canberra Night Interdictors

BY the end of the year, as foreshadowed in *Flight* last week, the first night interdictor Canberras will join 2nd T.A.F. in Germany. At first they will be B.6 bomber versions modified to carry a gun-pack in addition to bombs, but it seems likely that the B.8 will soon take their place.

The operational task of the night interdictor is of course approximately the same as that of the ground-attack aircraft by day, but a greater range of equipment and aids are necessary for operation at night, and this the Canberra is well able to accommodate.

Aircraft Golfers Forgather

THE president of the Aircraft Golfing Society, Brigadier-General A. C. Critchley, being down with 'flu, the chair at the Society's 11th annual dinner, in London on April 1st, was filled by G/C. Douglas Bader.

G/C. D. F. McIntyre, proposing "The President," said that Brig-Gen. Critchley had been in America watching helicopters (vehicles to which he himself was opposed!), and that G/C. Bader had just returned from Indonesia. Mr. H. G. Sturgeon, captain of the A.G.S., responding to the toast of "The Society" by Max McCready, said that of the 175 members some 60 attended each of 20 functions in each year. This year (as already reported in *Flight*) the whole Society was going to Paris for three days. Mr. Sturgeon referred to the value of the Society as a medium for bringing together the "people making small parts" and the big manufacturers.

Mr. Brian Songhurst (hon. secretary and treasurer) welcomed contingents from Scottish Aviation, Short Brothers, Blackburn and General, Percival, Armstrong Whitworth, Boulton Paul, Hawker, de Havilland, Folland and Vickers.

W/C. P. B. Lucas remarked on the affinity between golfers and aviators, notably in their discourse, e.g., drift to the right or left on landing, and even (he had heard an American use the expression) "stalling" on a putt. He recalled how, as he was returning from Lille in the late war at 25,000 or 30,000ft, the engine of his Spitfire failed, and he glided towards a golf course. He had hoped to set the machine down at the first hole, as being the flattest, but (so close was the affinity between flying and golf, to which he had referred) he finished up on the ninth fairway.

High Authority

THE Handley Page Victor has lately been "at home" to some distinguished visitors. On March 25th it was inspected by Mr. Selwyn Lloyd, the Minister of Supply, who flew in it at over 50,000ft; and a week later it carried to a similar height Mr. George Ward, Under-Secretary for Air, and Handley Page's deputy chairman, A. Cdre. A. V. Harvey. Mr. Ward himself flew the Victor for more than an hour and tried its "automatic landing" characteristic—recorded in the photograph above.

Seen in the group picture are: W. H. MacRostie (chief engineer), S/L. H. G. Hazelden (chief test pilot), F/L. J. W. Allam (the test pilot who flew Mr. Ward), A. Cdre. Harvey, Mr. George Ward, R. S. Stafford (director, technical department), and Sir Frederick Handley Page.

On April 4th the Victor's performance was sampled by Air Marshal T. G. Pike, Deputy Chief of the Air Staff.

NATO Advances

THE fourth anniversary of Allied Air Forces Central Europe—the largest of the NATO air commands, and the medium through which Great Britain contributes to NATO air power—was celebrated on April 4th at Fontainebleau. To mark the occasion the A.A.F.C.E. Commander, Air Chief Marshal Sir Basil Embry, addressed a parade of officers and airmen from Great Britain, the U.S.A., France, Canada, the Netherlands and Belgium, which countries contribute to the strength of the command.

Britain's contribution is the 2nd Tactical Air Force, with which, since 1952, have been co-ordinated squadrons and wings from Belgium and the Netherlands, to form the 2nd Allied Tactical Air Force. The remainder of A.A.F.C.E.'s operational strength is organized under the 4th Allied Tactical Air Force, to which contributions are made by the U.S.A., France and Canada.

A German Airline Again

APRIL 1st, 1955, was a red-letter day in the calendar for Deutsche Lufthansa, for on that day the German airline made its first commercial flight for almost exactly ten years. It was on April 21st, 1945, that a Lufthansa aircraft took off from Tempelhof, Berlin, for Munich and Madrid on what proved to be the last scheduled service before all aviation in Germany was halted at the dictates of the victorious allies. Now activities have been resumed to a schedule approved by the Western Powers.

At the start of this month domestic services within the Federal Republic were opened between Hamburg, Düsseldorf, Cologne, Frankfurt and Munich. The next development will be proving flights to London, Paris and Madrid—starting today, April 15th—preparatory to the inauguration of commercial services within Europe on May 15th. A transatlantic route to New York will begin operations on June 1st. That will complete the initial phase, although plans have already been made for a service to South America next year, terminating at Buenos Aires, followed by the development of a route to Teheran *via* Beirut and Istanbul, with a subsequent extension to the Far East.

To implement this programme Lufthansa ordered four Convair 340s, all of which were delivered in December and January, and eight Super-Constellations, the first of which is due to arrive at Fuhlsbüttel Airport, Hamburg, at about the time these words appear. Four Super Connies will be in the airline's hands this year and the remainder in 1956. In addition, it has acquired three Douglas DC-3s, to be employed for freight and training, and two Saab Safirs for initial pilot instruction. The following figures

A Convair 340, part of Lufthansa's initial equipment, is here seen being serviced and loaded on the apron at Rhein Main Airport.

give an interesting comparison between pre-war and present-day aircraft costs: A Junkers Ju52 could be bought for DM275,000 (about £23,000); the price of a Convair 340 is DM3 million (£250,000), and of a Super Constellation DM8,500,000 (some £708,334). In calculating the capital required to get started, Lufthansa allowed for an outlay of DM82,400,000 (nearly £6,900,000) for aircraft and a further DM31 million for spares.

At the head of the Lufthansa organization is Herr Hans M. Bongers (chief executive and general manager), who took over the preliminary preparations for the airline's restoration as long ago as 1951. Chairman of the board is Dr. Kurt Weigelt, who was the last pre-war chairman. Seven of the nine present executives also served the old company, as did about 35 per cent of the staff of 1,000, which is, of course, still being built up. Administrative headquarters are in the old university at Cologne, and the central operating and maintenance base at Fuhlsbüttel. Hamburg was selected after careful consideration—and in the face of several rival claims—because it was regarded as being the most conveniently placed.

Training of flying and ground staffs began some time ago. Some pilots took a course at Air Service Training, Hamble; others went to the United States. Under a friendly arrangement with British European Airways nine B.E.A. pilots have been seconded to Lufthansa for about a year to act as captains of Convairs and to instruct German pilots on them. They took a conversion course at Hamburg in January and have been conducting the proving flights in the Federal Republic, with the most advanced German fliers as co-pilots; the aircraft have also been carrying German stewards and stewardesses, who have already had experience with other airlines, including B.E.A. Except on the relatively long haul to Madrid the Convair flight crews will consist only of the two pilots; on the service to Spain a radio officer will be carried. American captains have been engaged for the Super Constellations, with a similar arrangement for training German pilots who will fly on the long-distance routes.

The present maintenance and overhaul staff of about 300 at Fuhlsbüttel will be increased when the four additional Super Constellations are delivered next year. Engineers have been trained in the United States and by European operators who use similar airframes or engines — K.L.M., Air France, Swissair, Sabena, and S.A.S. Lockheed, Convair, Pratt and Whitney, and Hamilton Standard technicians have been attached to the maintenance base.

Though it inevitably faces many difficulties, Lufthansa sets out with the advantage of a base which is as modern as the new ones occupied by the two British airways Corporations at London Airport. About a mile from the passenger terminal at Fuhlsbüttel, there have been built in one year a hangar, workshops, stores, offices and training establishment which many old-established operators might envy. The hangar floor space can be doubled when the need arises, and plans have been drawn up accordingly, but it is adequate for current requirements. Spaced conveniently along the length of the hangar, as part of the same building, are workshops and stores, and divided from these only by the width of a corridor are the offices.

A training school for flying and technical staffs was opened last September. There are instruction facilities for pilots, cabin staff, radio operators, and engineers. Three Link trainers have been installed, and to give realistic training to stewards and hostesses there are mock-ups of a Convair and Super Constellation. An engine test-house will be ready by the summer.

Estimated income for the first full year of operation is DM45,400,000 and Herr Bongers told a recent gathering of travel agents in Hanover that Lufthansa hopes to achieve economical operation during 1957, after which a Government subsidy would no longer be required. By that year the company expects to be offering a capacity of some 650 million passenger-miles—more than twice the maximum provided by the pre-war airline.

It is to the long-distance routes that Lufthansa is mainly looking to achieve economical operation. The initial frequency of six services a week across the North Atlantic this summer will be doubled in 1956, and there will be a twice-weekly service to South America and three a week to the Middle East. After this long-distance system has been consolidated Lufthansa proposes to extend its European network considerably.

The first of Lufthansa's Super Constellations, complete with wing-tip tanks, rolls off the line at the Lockheed factory, Burbank, California. This and several other aircraft will join the operating fleet this year. They will be commanded by American Captains, 11 of whom have been seconded from T.W.A., until their German co-pilots are qualified to take over. The formal inauguration of Lufthansa's services is illustrated on page 500.

HERE AND THERE

Royal Familiarization

AT the controls of de Havilland's Heron demonstrator, G-AMTS, the Duke of Edinburgh flew last Saturday from White Waltham to Cornwall and back. Accompanied by F/L. C. Gordon, he was airborne for some three-and-a-half hours.

Co-operation Needed

IN a recent speech at Hobart, Mr. Townley, Australia's Minister for Air and Civil Aviation, said he believed there to be an urgent need "for closer integration of Britain and the U.S.A. in sharing scientific resources, especially in the field of aviation." Some *Flight* readers may recall that we made this very point in a leading article last year (June 11th).

Speedster's Bonus

THE Los Angeles to New York speed record established last month by Lt-Col. Robert Scott in an F-84F Thunderstreak has been confirmed by the National Aeronautic Association at 3 hr 44 min 53 sec—1 min 46 sec shorter than the time tentatively announced; this raises the speed from 649 to 652 m.p.h. Scott's aircraft was the fastest of three machines which completed the distance of over 2,400 miles.

Farnborough Steps Out

AS part of next month's golden jubilee celebrations of the R.A.E., the Senior Staff Mess is holding a ball on Friday, May 27th, and hopes for the attendance of as many past members as possible. Information is obtainable from the Mess hon. secretary, Mr. K. W. James.

No Great Aviation Art?

OPENING an art exhibition in London on April 2nd, Lord Douglas of Kirtleside, B.E.A.'s chairman, said that, speaking as an airman, he had often felt some surprise that this modern age had not produced any air artist of note. He added: "We have portraitists, landscape artists, marine artists, but we have yet to produce our own inspired masterpieces of the air which are typically and entirely air pictures." In the organization of the exhibition, entitled *Industry, Old and New*, B.E.A. had co-operated with the Royal Society of British Artists.

SOMEWHERE EAST OF SUEZ is the destination of each of these de Havilland products. Nearest the camera is a Vampire Trainer for Burma, and beyond, in succession, are a Venom fighter/bomber for Iraq, a Vampire night fighter for India, and a Vampire fighter/bomber for Egypt.

Austers to Rescue

FROM Australia, Auster Aircraft, Ltd., have just heard that two Aiglets flew over 32,000 miles in seven weeks on work in connection with the recent disastrous floods. During this period they kept more than 100 homesteads and the whole town of Muttaburra, Queensland, supplied with foodstuffs and medical necessities. The pilots were Jesse Luxton and Reg Burrow, of Somerset Airways, the owners of the aircraft. Capt. Luxton will be remembered as manager, some years ago, of Loxhams Flying Services, Blackpool.

J47 Cutback

THE U.S.A.F. is reducing production of the General Electric J47 turbojet "because of increased engine life and reduced requirements." More than 1,500 of these units, the most notable application of which is the Boeing B-47 Stratojet bomber, are being cut from G.E.'s orders. Over 35,000 have been delivered to the U.S.A.F. during the past seven years.

"No Answer to the Valiant"

THE Supreme Allied Commander, Europe, Gen. Gruenther, appearing with Lord Ismay, Secretary-General of NATO, in a B.B.C. television programme entitled "Keeping the Peace" on April 4th, said of the Vickers-Armstrongs Valiant, "There is no answer to that 'plane at this time, either by the Soviet or by our side." He went on to say that when the German contribution to NATO was effective, about three or four years after ratification, we were going to be able to defend Europe "against an all-out act of aggression if, unfortunately, it should come." In the meantime, NATO had a tremendous advantage in long-range air power, specifically that which stemmed from the B-47 and the Valiant.

Pentagon Visitor Here

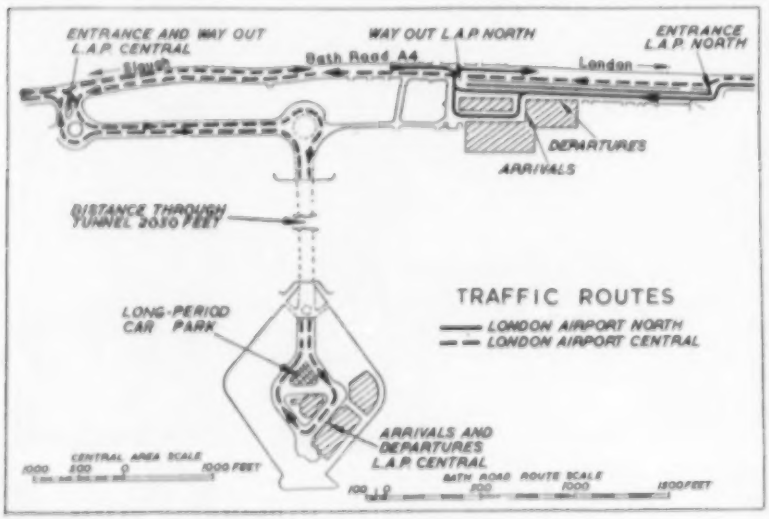
THE UNITED STATES Assistant Secretary for Air, Mr. Trevor Gardiner, arrived in London from Washington on April 3rd. He travelled in a U.S.A.F. VC-121 Constellation with other Government officials and Service officers. The purpose of his visit was not disclosed.

City and Guilds Fellowship

AMONG past students of the City and Guilds College upon whom the Fellowship of the City and Guilds of London Institute was recently conferred is Mr. N. E. Rowe, technical director of Blackburn and General Aircraft, Ltd. He entered the College as a Whitworth Exhibitioner in 1921 and in 1924, before going to the R.A.E., he took a first-class honours degree and the Diploma of Imperial College.

L.A.P. Road Traffic

AS announced in *Flight* last week, the first stage of the new London Airport Central passenger arrangements comes into operation this week-end. Those who have cause to visit the new area may find the accompanying road diagram helpful. A large car-park for use by passengers and their friends has been laid out on a triangular site near the exit from the tunnel. This is the "long-period" park indicated on the map; a waiting area for cars stopping not more than 20 minutes is situated alongside the passenger buildings. "Spectators' traffic" will turn left out of the tunnel and follow road signs leading to parks with a total capacity of some 1,500 vehicles.



THIS WAY IN: The new London Airport traffic routes, referred to in the paragraph immediately above.

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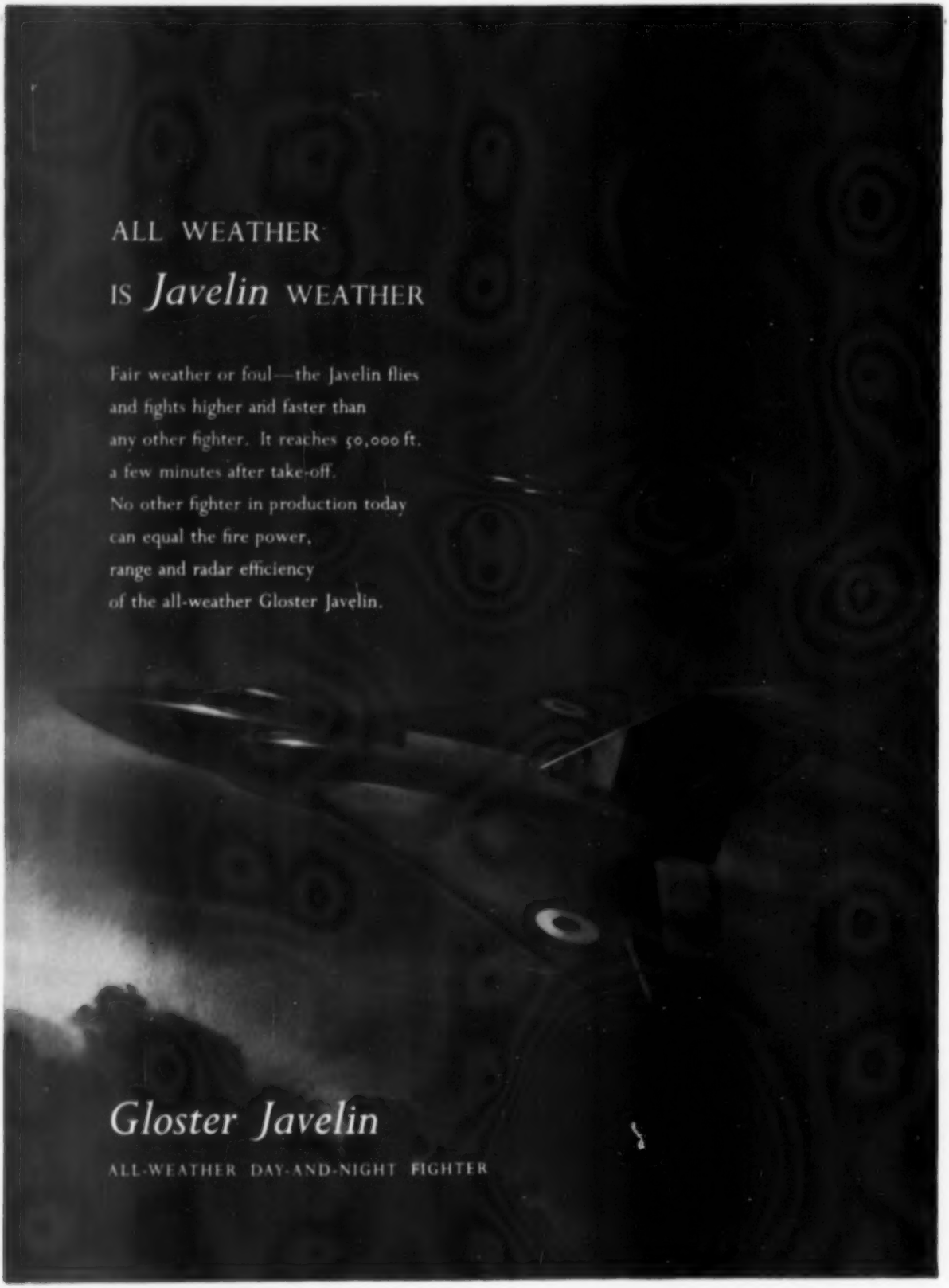
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a few minutes after take-off.
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MANUFACTURERS' EVENING OUT

Wit and Wisdom at the Contractors' Dinner at Boscombe Down

THE dinner which the Air Commodore and Officers of the Aeroplane and Armament Experimental Establishment give each year to the British aircraft contractors took place on April 1st at Boscombe Down as usual. The dining hall was packed to capacity; and, both before and after the more formal part of the evening, the "contractors"—the heads and chief designers of the principal manufacturing companies—were to be seen with the test pilots of the industry and Services and Ministry of Supply technicians, engaged in their favourite pastime of combined shop-talk, leg-pulling and reminiscence.

After an excellent dinner—the menu seems to have improved each year since the war—A. Cdre. A. H. Wheeler, the Air Officer Commanding the Establishment, rose to propose the guests. It was, he said, the third time—and would, unfortunately, be the last time—that he had the honour of proposing this toast. It was 13 months instead of 12 since the last dinner, but at the rate which people worked at Boscombe it was traditional to get far more into a year than was normally expected. He also made the perennial reference to the inadequacy of the Mess.

A. Cdre. Wheeler specially welcomed Sir Sydney Camm, who was to reply to the toast. He then went on to say that, during the year, a start had at last been made on the full testing of V-class bombers. He was glad that the Naval squadron at Boscombe had been awarded the Boyd Trophy for the best performance by any Naval squadron during the year. He thanked Sir Richard Fairey for its original presentation, and congratulated Cdr. Orr on the efficiency of his winning squadron. The Air Commodore went on to recall that during the year there had been an unprecedented event for the Establishment, in the shape of a visit from the Press, which had been most broad-mindedly permitted by the Ministry of Supply. The Establishment had nothing but gratitude for the really appreciative interest taken in its work, and for the way in which it had been reported.

An event of the year was the fact that the A. and A.E.E. had been instructed to test the Heron which de Havillands were preparing specially for the Duke of Edinburgh. A. Cdre. Wheeler spoke most appreciatively of the work of Mr. Handel Davies, and of his three-year association with him. [Mr. Handel Davies has already taken up his new appointment as Scientific Adviser to the Air Ministry but was present as a guest. The new chief superintendent is Mr. J. Hanson.—Ed.]

A. Cdre. Wheeler recalled that, when he and Mr. Handel Davies first went to Boscombe the latter had said to him "in a place like this, you can't do everything. Let us try at least to be able to claim some concrete achievement." After some discussion, it was decided that they should try to foster that spirit of goodwill and smooth running which, in their opinion, should prevail in all their work. An example of their intentions in practice was provided by the re-wording of a report on an aircraft. Originally it had read "this aeroplane stalls without any warning at all and is dangerous." The corrected version read "a more definite stall warning would enable pilots to exploit fully the otherwise excellent slow-flying qualities of this aircraft." He had also come across a phrase in one of the Establishment's reports which indicated that broad-minded tolerance could begin at home: referring to a Naval aircraft, it read "one exceptionally heavy landing which occurred is considered to be unrelated to the aircraft's characteristics."

A. Cdre. Wheeler went on to say that information had trickled through that there were still some members of the aircraft industry who considered that Boscombe Down was only a useless delaying link in the chain of aircraft development. Having often heard this criticism before, he had made a historical study back into the remotest ages. For example, the Romans certainly insisted on all military equipment being approved by their legionaries. The Greeks, who were great individualists, both selected and tested their weapons themselves, so there was no precedent there. Going further back to Egyptian methods, one could be sure that the Pharaohs wanted to have the longest possible preview of their Pyramids before putting them into operational use. Only when he had gone back to the first chapter of the Book of Genesis, said the speaker, did he find the famous recorded case where a manufactured product was subjected to checking only by the maker and had proved satisfactory ever since.

Boscombe Down had had the usual quota of crises in the past year. The arguments, perhaps, grew heated, the M.o.S. got interested and even the Air Ministry started taking a hand. Ministers rang up, the Air Marshal perhaps flew down, then, almost at the climax, the battle rolled on to other spheres, perhaps to the corridors of Whitehall, perhaps even nearer to the centre of the city of Westminster, and a sort of peaceful desolation settled for a short time on Boscombe Down. A. Cdre. Wheeler thought this resembled one of the old pictures of some battlefield—the usual wreckage, a few dead horses, perhaps, and a broken gun carriage or two, and the whole atmosphere one of silent desolation. Boscombe Down had often reminded him of such a picture: a few discarded ailerons or elevators in a corner of a hangar; the dead horses were replaced by a heap of intake baffles which had failed to achieve their job or which the aircraft designer had resolutely refused to fit. But the air of silent desolation was soon disturbed, for on the northern horizon was seen appearing a delta shape, slim and clean—delta-shaped because it was the fashion these days, slim because it was supposed to go faster, and clean because it had not yet arrived at Boscombe Down. . . .

Speaking more seriously, the air commodore said that the Establishment still valued the tradition of working together and really tried to foster it. Boscombe appreciated how irritating it was to makers when things went wrong with their products there. Said the Air Commodore "we take no delight in watching spanners going into the works. We, like you, only want the Services to have the best possible equipment in the shortest possible time."

In his reply on behalf of the guests, Sir Sydney Camm briefly recalled the aircraft reports of Martlesham days. He then spoke of the difficulties of designers today, and quoted the passage from *Horatius* "Those behind cried 'Forward!' and those before cried 'Back!'" Bombers were always going higher and faster. With the advent of missiles, it had been said in 1947 that there would be only one more fighter. Here Sir Sydney referred cryptically to Mr. Petter's return from India and added that some designers had fighters weighing 60,000 lb to 100,000 lb in mind. Of one thing he was certain, and that was that the time involved in re-equipment must be shortened, but aircraft must be evolved gradually over small steps. He concluded with a tribute to the ready co-operation of Boscombe. He would like to see the Establishment increased both in power and size.

The toast of the aircraft industry was proposed by Air Chief Marshal Sir John Baker, Controller of Aircraft, M.o.S. He paid tributes to the work of Boscombe Down and particularly to A. Cdre. Wheeler and Mr. Handel Davies, and he welcomed A. Cdre. Ramsey Ray and Mr. Hanson, who are taking over from them. The final speech, a reply on behalf of the aircraft industry, was by Mr. S. D. Davies, Avro's chief designer. Speaking of the contrasting interests of the industry for whom he was replying, he remarked that, after all, aeroplanes would not go without engines and equipment; in fact, the airframe was becoming little more than an envelope for the engine and even the engine people complained because their job seemed to be becoming one of driving pumps. Regarding the line he should take, and the earlier reference to delta bombers, he indicated his difficulty by mentioning "a plausible looking project at Manchester which should be capable of knocking down deltas or any other bomber."

With forthcoming trials in mind, Mr. Davies remarked that gratitude had been defined as a lively sense of favours to come, but the industry must not expect to be spoon-fed. It should endeavour to become more independent in technical matters. It would be stupid to blame future failures on lack of facilities in the industry. The rate of technical development was increasing so fast that the only hope of producing aircraft quickly was to get them right first time. So much more research was needed and he placed structures before aerodynamics. Computors were valuable for the "simple plumbers" of the aircraft industry and it should not be imagined that these were "long-haired stuff, only for Americans." More computors were needed. A small country such as ours had to live on technical ability.

MORE TITANIUM FOR DC-7s

MORE titanium is now being used in the construction of later models of the DC-7. The amount is 800 lb per airframe, as compared with 450 lb in early models. The nacelles of the DC-7B and DC-7C are almost entirely made of the new metal and the "saddle" tanks fitted over the nacelles will also be fabricated from it. Some nacelle frames, the undercarriage doors and the firewall webs are also of unalloyed titanium.

Titanium does not pay in all applications, however, and the cost per pound of weight saved by the use of certain titanium bolts was found to be $400—hardly an economical proposition.

Even on the ground the D-type Sabre looks every inch "a hot ship," and something of its personality is even manifest in the photograph on the right. Here, a machine from the 513th Squadron is seen in a very domestic state; in particular, the package housing 24 air-to-air rockets is visible below the fuselage, extended for servicing.

THE D-TYPE SABRE

World's Fastest All-weather Intercepter

ALTHOUGH it is easy to dismiss it as "just a Sabre with a radar nose," the machine illustrated in these photographs (the North American F-86D) is probably the most interesting fighting machine to have entered squadron service for many years past. It is a single-seater, yet it flies at night or in bad weather. It is a fighter, yet it carries no guns. And it has many other curious features, and introduces new techniques, the details of which must remain, for the present at least, strictly "classified."

Squadrons of these fine aircraft are now serving in the United Kingdom, under the operational control of Fighter Command. The aircraft shown are based at Manston, Kent, and are on the strength of the 406th Fighter/Intercepter Wing, U.S.A.F.

Like other American aircraft designed for all-weather interception, the F-86D is armed with the "Mighty Mouse" rocket, a 2¾in-diameter spin-stabilized missile with folding fins, which is aimed like fixed-gun armament. A total of 24 of these missiles is accommodated in a retractable package which normally lies flush inside the Sabre's belly. The package is extended and the rockets fired automatically, according to the directions of a very advanced form of electronic control system. Every device that can ease the task of the pilot is incorporated in this aircraft, and, as a result, in both cost and complexity the D-type Sabre sets a record for aircraft of this size.

Naturally enough, the F-86D is a good deal heavier than are the day Sabres, and the normal rated power of its General Electric J47-GE-33 turbojet (around 5,800 lb thrust) is hardly enough for flashing performance. The "D" has, however, a trump card in its tail: this mark of J47 has an afterburner, and nearly a ton of additional thrust is available when required. With the afterburner in action the "D" is roughly 100 m.p.h. faster than any other all-weather fighter, and it once held the world speed record at over 715 m.p.h. with full military equipment.

We recently visited a squadron of these machines and learned something of what they can do and how they do it. A descriptive article will, security clearance permitting, appear in due course.

"FLIGHT" photographs

Compared with the F-86F, the D has a larger tailplane, without dihedral; this tailplane is also unusual in that it is of the single-surface slab type. The wing is slatted, also in contrast to day Sabres.

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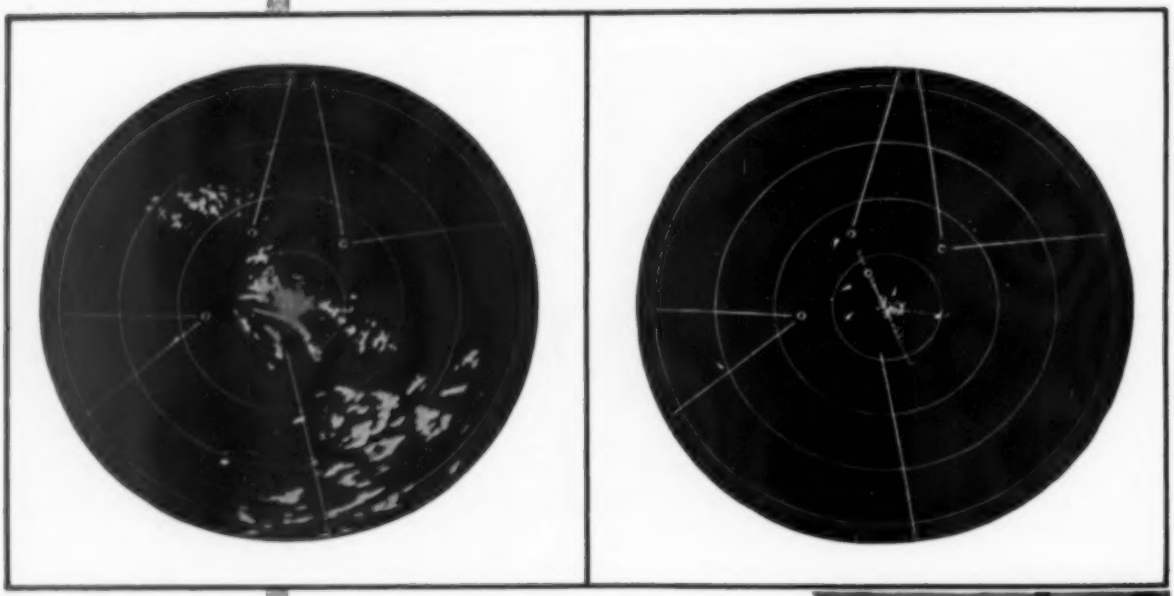
COSSOR ENGINEERS MOVE THE ALPS

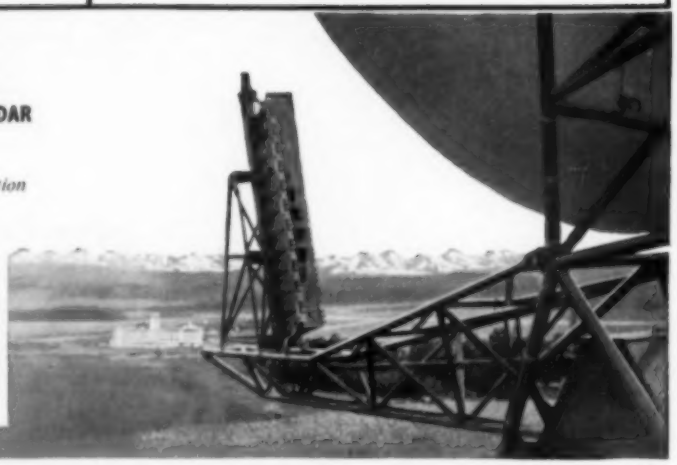
These two 40-mile range PPI photographs were taken on the Cossor Airfield Control Radar Mk. VI now installed at Zurich, Switzerland. That on the left is the normal radar display. The other PPI (right) shows clearly the effectiveness of the Cossor developed PERMANENT ECHO CANCELLATION circuits; the moving aircraft responses previously obscured are now revealed. Mountainous terrain such as is found in Switzerland, with saturation ground returns, has hitherto been a nightmare for radar operators. Cossor engineers specialize in advanced development of this kind and have produced

THE FINEST CONTROL RADAR—ACR MK. VI BY COSSOR.



COSSOR AIRFIELD SURVEILLANCE RADAR (ACR Mk. VI)

A view of the installation at Zurich Airport.



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WINGS FROM THE WEST

FORTY YEARS OF WESTLAND **BY H. F. KING, M.B.E.**

With a special contribution from Harald Penrose, O.B.E., F.R.Ae.S., A.M.I.N.A.

PART 1: 1915-1955

THROUGHOUT the flying-world today the names Westland and Yeovil connote a busy aircraft works. Yet they are still evocative of rural tranquillity; and though Westland products have won fame and favour in many lands, as these pages show, the company of their origin is still affectionately regarded as something of a country cousin in the family of British aircraft constructors.

The records show that it was forty years ago this month—in April 1915—that grievous shortages of munitions were exposed by Mr. Lloyd George, and that the directors of Petters, Ltd., of Yeovil (then making oil engines, electric lighting plant, lorry components and shells) resolved to place their company's entire manufacturing resources at the Government's disposal. That resolution was notified to—among other Departments—the Admiralty, who responded by requesting the company to undertake the manufacture of aircraft. Available accommodation was assessed as being sufficient to provide a nucleus of that foreseen, and arrangements were made for working drawings of the Short "225" seaplane to be supplied by Short Brothers. It was further arranged that Commander R. A. Bruce, R.N., then acting as overseer at the Sopwith Aviation Company's Kingston factory, should be allowed to resign his R.N.A.S. commission and to take charge of the new west-country works as from July 1915. Accompanied by Mr. Arthur Davenport, Mr. Seaman, Mr. John Petter, Mr. Perry, Mr. Percy Warren and Mr. R. G. Dellow, Mr. Bruce attended at Short's Rochester works for a fortnight's instruction in the "intricacies" of the seaplane, and by August of that year manufacture of "225s" was under way at the Westland Aircraft Works (branch of Petters, Ltd.). By January 1916 the first machine had been delivered to Short Bros. for air-testing.

Following the "225"—which took that unofficial appellation from the power of the Sunbeam engine fitted—came another batch of Shorts of somewhat smaller type, with Swiss Canton Unné water-cooled radial engines. Drawings of this machine were by no means complete, and in helping to remedy the deficiency the company was able to build up its own "D.O." under Mr. Bruce, with Mr. Davenport as his chief assistant. In all, 32 Short seaplanes were delivered from Yeovil.

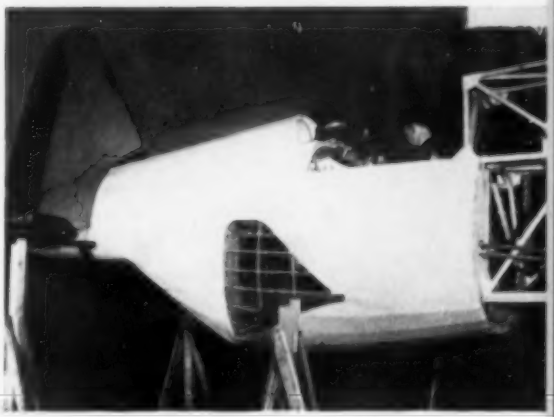
The first landplanes constructed were 75 Sopwith 1½-Strutters, the earliest of which were despatched by rail, as had been the practice with the seaplanes; but acquisition of adjacent land, which had been made ready as an aerodrome by the spring of 1917, enabled the later 'Strutters to be delivered by air.

Quickly the new works grew in extent and efficiency, and by April 1917 the first of 150 Westland-built D.H.4s had been tested by that great pilot "Benny" Hucks and delivered to the Western Front. The earlier D.H.4s were engined with the 200 h.p. B.H.P., but this was displaced in later production first by the 250 h.p. Rolls-Royce Falcon, and ultimately by the 360 h.p. Eagle. There followed an order for another 150 de Havilland reconnaissance bombers, this time of the D.H.9 type, with Siddeley Puma engine.

Hitherto the company had been mainly concerned with construction and assembly, though in the matter of original design they had been entrusted with a twin-Vickers-gun installation for the D.H.4. When, however, the 400 h.p. Liberty engine became available in large quantities, an urgent Air Board requirement

Heading picture: Wapitis of No. 601 (County of London) (Bomber) Squadron, A.A.F., photographed by John Yoxall of "Flight" in 1930.

Some intimate glimpses of Westland aircraft: (Left) Interior of the 1919 Limousine. The upholstery was in grey Bedford cord. (Top left) Torpedo installation on the P.V.7. (Top right) The Pterodactyl V, with cowlings removed. (Right) Mock-up lower-rear-gun position for a Lysander ("The Cow").



WINGS FROM THE WEST . . .

arose for a development of the D.H.9, to be fitted with this famous American power unit; and the drawing office of the Aircraft Manufacturing Company (later the de Havilland Aircraft Co., Ltd.) itself being preoccupied with the D.H.10 twin-engined bomber, the Westland Aircraft Works was nominated as the parent company for the new D.H.9a. Westland drawings were issued to other factories engaged in the D.H.9a programme as the Yeovil works got under way with their own contract for 423 machines of the type. Of these, 390 were completed before the Armistice. Thereafter, until the 9a was succeeded in R.A.F. service by the Wapiti and other general-purpose machines of post-war design, Westland remained as the parent company for the type, being largely responsible for reconditioning and modification.

To original Westland designs (a three-view drawing dated 21/12/18, and passed by Mr. Davenport, is by us as we write) the company built the N.16 and N.17 seaplanes. These Bentley-engined Naval fighting scouts were never produced in quantity owing to the acceptance of the landplane type of aircraft to discharge their intended duties.

Westland's drawing office was now well established, and the production side had earned such a reputation that it was to receive during 1918 a contract for 25 of the new Vickers Vimy twin-engined bombers. These fine aircraft were intended for decisive raids on Berlin, and for their manufacture a special erecting shop was put up at Yeovil. The Vimys were tested by S/L. Rollo de Haga Haig, A.F.C., one of the most dashing of the Martlesham pilots, and in December 1918 Capt. A. S. Keep, M.C., B.Sc., a gallant bomber pilot of the Independent Air Force, was posted to Yeovil as an Air Ministry test pilot. On his demobilization Capt. Keep accepted a position with the company. He was concerned in the testing of the Wagtail and Weasel fighters, and by the summer of 1919 he was flying the Limousine—one of the first post-1918 transport machines of original design. A handsome and dignified Westland brochure of 1919 describes the Limousine, together with various war-time productions of the company, and contains the specifications of a projected seven-seater twin-engined "Colonial mail carrier," to be powered with two 100 h.p. Cosmos Lucifer or 150 h.p. A.B.C. Wasp engines. In that brochure the departmental staff of the company is given as: Robert A. Bruce, managing director; Robert J. Norton, commercial manager; Arthur Davenport, chief draughtsman; Frank Chandler, works manager; Capt. A. Keep, M.C., R.A.F., official pilot.

"The erecting shops, just completing in the early summer of 1919," runs a note in the brochure, "admit of the completion of machines up to a height of 30 feet by 150 feet span . . . The workshops lie alongside of the Great Western Railway line from Yeovil to Taunton and sidings run into the workshops . . . A first-class system of heating throughout all the buildings has been adopted and the ventilation has been carefully attended to, a matter of vital importance where wood forms the chief material used for construction."

Through the difficult post-war years the gifted, well-loved Mr. Bruce continued to lead the way. In the autumn of 1920 an enlarged six-seater development of the Limousine took the first prize of £7,500 in the "Small-type Aeroplanes" class of the Air Ministry Competitions for civil aircraft, run at Martlesham Heath, and at about the same time the Westland design staff was engaged on the remodelling of the D.H.9a as a Lion-engined three-seater fleet spotter. The necessary redesign was dictated by very exacting Air Ministry requirements (over- or under-imaginative, according to the point of view), and the Walrus, as the resulting machine was known, was indeed a bewhiskered sea monster. But the way of aircraft development was then, as now, a curious one, and following this shockingly "dirty" biplane came a cantilever monoplane of strikingly modern form, built according to the ideas of a Russian, and known as the Dreadnought Postal Monoplane. On the first, and only, flight of this machine, Capt. Keep sustained grievous injuries; but he prevailed over them to render many years of exemplary service to the company. He retired in 1935.

The 1920s were lean years, which the staple "bread-and-butter" diet of D.H.9a reconditioning did little to fatten. Some stimulus to spirits and to design-thinking at Yeovil was afforded by the Light Aeroplane Trials at Lympne during 1924, for which the company produced the Woodpigeon biplane and Widgeon monoplane, with the subsidiary object of determining relative efficiencies. Though neither type was immediately successful, the Widgeon was progressively developed into the Mk III production version, of which two dozen were eventually sold to private owners.

The Yeovil day bomber was a good aircraft, but was beaten in an Air Ministry Competition by a better one; and a change in official policy led to the abandonment of the Westbury twin-engined fighter, mounting two 37 mm guns. Hopes of production orders revived with the building of the Wizard single-seat fighter, a parasol-wing monoplane which diverged sharply in layout from contemporary British practice. But still no contract was forthcoming; nor was the good-looking Witch high-altitude monoplane day bomber more fortunate in securing business. Ultimately it was a straightforward D.H.9a replacement—the familiar and endearing Wapiti biplane—which was to bring the resurgence of activity so long awaited at Yeovil; and with the Wapiti came metal construction on a production-line basis.

Faithful mount of the R.A.F. on frontier and desert patrols, the Wapiti was issued on an extensive scale also to squadrons

In two wars women played a decisive part at Yeovil. (Left) The dope shop in 1918. (Right) His Majesty King George VI observes stressed-skin construction methods during the late war. In attendance on His Majesty are Mr. W. E. W. Petter, Air Marshal Sir Wilfrid Freeman, and Mr. Eric Mensforth.

of the Auxiliary Air Force (as it was then); it served in Australia, South Africa, Canada and China; in Saudi Arabia, Egypt and Turkey; and one was chosen, by reason of the established reliability and tractability of the type, as the personal aircraft of the Prince of Wales. In all, 565 Wapitis were built, exclusive of 113 Wallaces—the Wallace being a re-engined and cleaned-up development of the same basic type, and having, in its Mk II form the first complete cockpit-protection system to go into production for the R.A.F.

During 1926 Capt. G. T. R. Hill, M.C., M.Sc., originator of the Pterodactyl tailless aircraft, joined the company to undertake joint development of that class of machine under Air Ministry sponsorship. The culminating Pterodactyl was the Mk V two-seat turret fighter of 1932, and the story of the Pterodactyl typifies the company's willingness—indeed eagerness—to venture along new paths of development. Another instance of this was the building of a low-wing monoplane intercepter, to the F.20/27 specification, and a "cow gun" fighter (armed with the 37 mm C.O.W. gun) of similar layout.

On the military side, however, the monoplane was out of luck and out of favour, though in the civil field the three-engined Westland IV cabin monoplane, and its successor the Wessex, achieved a definite, if limited, success. And not in this country alone, for the type rendered good returns in the service of Sabena.

It was two biplanes of classic type which were ultimately to bring the name of Westland to the headlines of the world Press. One—the Houston-Westland—was a conversion of the multi-purpose P.V.3; the second was a modified Wallace. No finer machines could be found to undertake the noble enterprise for which they were destined—the first flight over Everest. Sturdy but light, they were readily adaptable to take the fully supercharged Bristol Pegasus engine, and test flights by Harald Penrose—a man whose record of service is unsurpassed in the company's history—proved that the two machines were in every way worthy of the great adventure. They succeeded magnificently on April 3rd, 1933; but so ephemeral was their fame that they were returned to workaday tasks and finally (we sorrow to record it) broken up.

As a Service replacement for the Wapiti and Wallace the P.V.7 monoplane was tested during 1931 and showed great promise before meeting the violent end described by Mr. Penrose in a subsequent page. The last Westland biplane was the F.7/30, a remarkable four-gun single-seater with an enclosure for the pilot and a Goshawk engine mounted amidships. It was not to succeed, however, in the competition for which it was designed.

In 1934—the year in which Mr. Penrose was testing the F.7/30 and in which the remarkable C.29 five-seater Autogiro made its all-too-early and too-brief appearance—Mr. Bruce retired, though the company continued to benefit from his advice. On his departure Sir Ernest Petter became chairman and managing director, with Capt. Keep as general manager and Mr. W. E. W. Petter (now managing director and chief designer of Folland Aircraft, Ltd.) as technical director. It was in 1934 also that Westlands constructed, to the designs of Mr. Basil Henderson and to the order of Mr. Whitney Straight, the prototype of the Hendy Heck low-wing monoplane. This was of very advanced aerodynamic design, fully slotted and flapped, and achieved a maximum speed of 180 m.p.h. on the 200 h.p. of a de Havilland Gipsy Six engine. Landing speed was a mere 40 m.p.h.

In July 1935 the Westland Aircraft Works was formed into a public company, with the title Westland Aircraft, Ltd. Directors were named as Sir Ernest Petter (chairman and managing director), Capt. P. D. Acland (joint managing director), A.V.-M. N. D. K. MacEwen and Mr. W. E. W. Petter, and the company was said to have on hand orders amounting to £300,000.

In *Flight* of October 22nd, 1936, it may be read: "Almost coincident with the completion of the twenty-one years since the Westland Aircraft Works began the construction of aeroplanes for His Majesty's Government, Westland Aircraft, Ltd., as the company is now known, were able to demonstrate one of the most interesting military aeroplanes in the air today. The machine was their new army co-operation monoplane, which has been adopted as standard equipment for the R.A.F."

The army co-operation machine alluded to was eventually named the Lysander and was the ultimate vindication of Westland's faith in the monoplane. Although a relatively intricate machine for those times, having a quite elaborate system of slots and flaps, the prototype was designed and constructed in twelve months. Ultimately, 1,373 of these monoplanes were built.

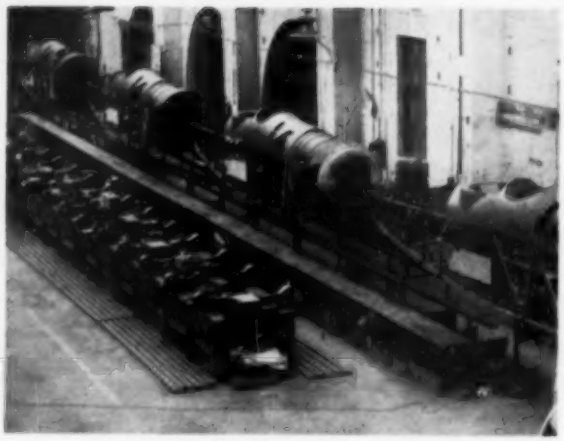
The Lysander supplanted in R.A.F. service the Hawker Audax and Hawker Hector biplanes, both of which types had been built by Westlands themselves, the respective production totals being 43 and 178. Lysanders were eventually engaged on arduous and dramatic duties far removed from those covered by Specification A.39/34, to the requirements of which the design was prepared.

In 1936 the company was awarded a contract for a twin-engined single-seat fighter of very striking appearance and having a nose-mounted armament of four 20 mm guns. This was to achieve war-time fame, especially in the attack role, under the name Whirlwind; and upon the design of the Whirlwind (of which 116 were built) was to be based the Welkin high-altitude intercepter, with its pressurized, armoured cockpit and 70ft wing-span. Fifty-three Welkins and detail components for another hundred were completed.

In 1938 the great Clydeside shipbuilding firm of John Brown and Co., Ltd., acquired from Petters, Ltd., a controlling interest in Westland Aircraft, Ltd., an event which called forth a leading article in *Flight*. "That the new deal will result in increased output from the Yeovil factories," ran this article, "is not to be doubted, although it must of necessity be some time before the Petter works (acquired at the same time) can be converted to aircraft production. All parties are to be congratulated on the deal. John Brown will enter the aircraft industry by way of a firm with a very good reputation, and Westlands will be able to extend their productive capacity without encroaching further on the Yeovil aerodrome. The design staff, under young Teddy Petter, is well qualified to attack modern problems, and the extra factory accommodation should, when in working order, enable manufacture to keep step with requirements."

That part of Petters' holding which had not been acquired by John Brown and Co., Ltd., was taken up at a later date by Associated Electrical Industries, Ltd.

As in the First World War the company had built some of the most successful designs of other manufacturers, so in the second it was to play a prominent part in the vast Spitfire and Seafire programme. Of Spitfires, Mks 1B, 5B and 5C, 685 were delivered; for the Seafire (Mks 2C, 2B, 15 and 17) the total was 1,409. Additionally, the company was engaged in the production scheme



(Above) The Wapiti line at Yeovil. (Top left) Wapiti IIas of No. 30 Squadron patrolling the mountains of Kurdistan in 1934. (Lower left) Wallace Is of No. 501 (City of Bristol) (Bomber) Squadron—a Cadre unit based at Bristol—also photographed in 1934.

WINGS FROM THE WEST . . .

for the Barracuda; but so heavy were its Spitfire and Seafire commitments that it withdrew from the scheme after building eighteen of the Fairey torpedo bombers. Westlands, too, built a large number of centre-sections for the Armstrong Whitworth Albemarle; and they were responsible for a great amount of Spitfire and Seafire repair work, and for the armour and armament of Curtiss Hawks, Tomahawks and Kittyhawks. (Mr. Penrose recalls the trouble experienced in getting the American engines to work because they were so full of inhibitors. He made several forced-landings on this account.)

In June 1943 the services of Mr. Eric Mensforth, the managing director, were loaned by the Board to the Minister of Aircraft Production. His new post was that of chief production adviser to Air Marshal Sir Wilfrid Freeman, Chief Executive, M.A.P.—an eloquent testimony to the esteem in which the company was held at the highest level.

For the Welkin fighter the company had developed an automatic pressure-control valve, the success of which is attested by the fact that it was used on every pressurized British military aircraft built during the late war. To exploit this valve and associated equipment in post-war years a subsidiary company, Normalair, Ltd., was formed in 1946. Normalair continues at the present time with the development of equipment for cabin air-control in high-altitude flight, and has two overseas subsidiaries, Normalair (Canada), Ltd., and Normalair (Australia) Pty., Ltd.; and Normalair equipment is used today not only in every British pressurized aircraft but in a number of foreign types also, including the Avro Canada CF-100 and 102.

With peace came the realization that the helicopter would be demanded on an ever-increasing scale for numerous and novel applications in the civil and military fields. But it was realized also that not a single British project for a helicopter existed. Thus, in *Flight* of January 23rd, 1947, it is recorded that arrangements had been completed whereby Westland Aircraft, Ltd., would build in this country the Sikorsky S-51 type of helicopter. "It will be recollected," runs the item, "that Westlands are not newcomers to the rotating-wing field. Many years ago they built the Westland-Lepère gyroplane, but official interest was somewhat lukewarm and nothing much came of the venture. This time the firm has the approval of the Ministry of Supply, and it may be expected that progress will be rapid and that the Westland-built S-51 will appear before very long not only in England but in European countries."

From the Yeovil works variants of the S-51, built to British standards from British materials, and powered in most cases with the British Alvis Leonides engine, were—and are still being—delivered to civilian operators, airlines and military arms. By 1951 a second production line was being established at Yeovil for an anglicized version of the larger S-55, the qualities of which assure it of an even wider success than that achieved by the S-51.

In the fixed-wing field the company produced, in 1946, the first piston-engined version of a naval strike fighter, which was to be progressively developed with turboprop power and eventually to enter service with the Fleet Air Arm as the standard aircraft of its class. Although this machine—the Wyvern—is not a seaplane, it is truly a modern counterpart of the N.16 and N.17, being a single-seat ship-borne aircraft of high performance and carrying a projectile load in addition to heavy gun armament.

The contention that the development of the present-day Wyvern has occupied the whole of the elapsed period since the first flight of the original piston-engined machine late in 1946 is unfair. Of two available types of turboprop, only the Rolls-Royce Clyde could be installed in the existing fuselage, and it can now be said that the Westland pilots were strongly in favour of this version. They were convinced that it could be deck-landed within a few months of its first flight. The Armstrong Siddeley Python, however, offered greater power, and this consideration, coupled with the manufacturer's production facilities, proved decisive.

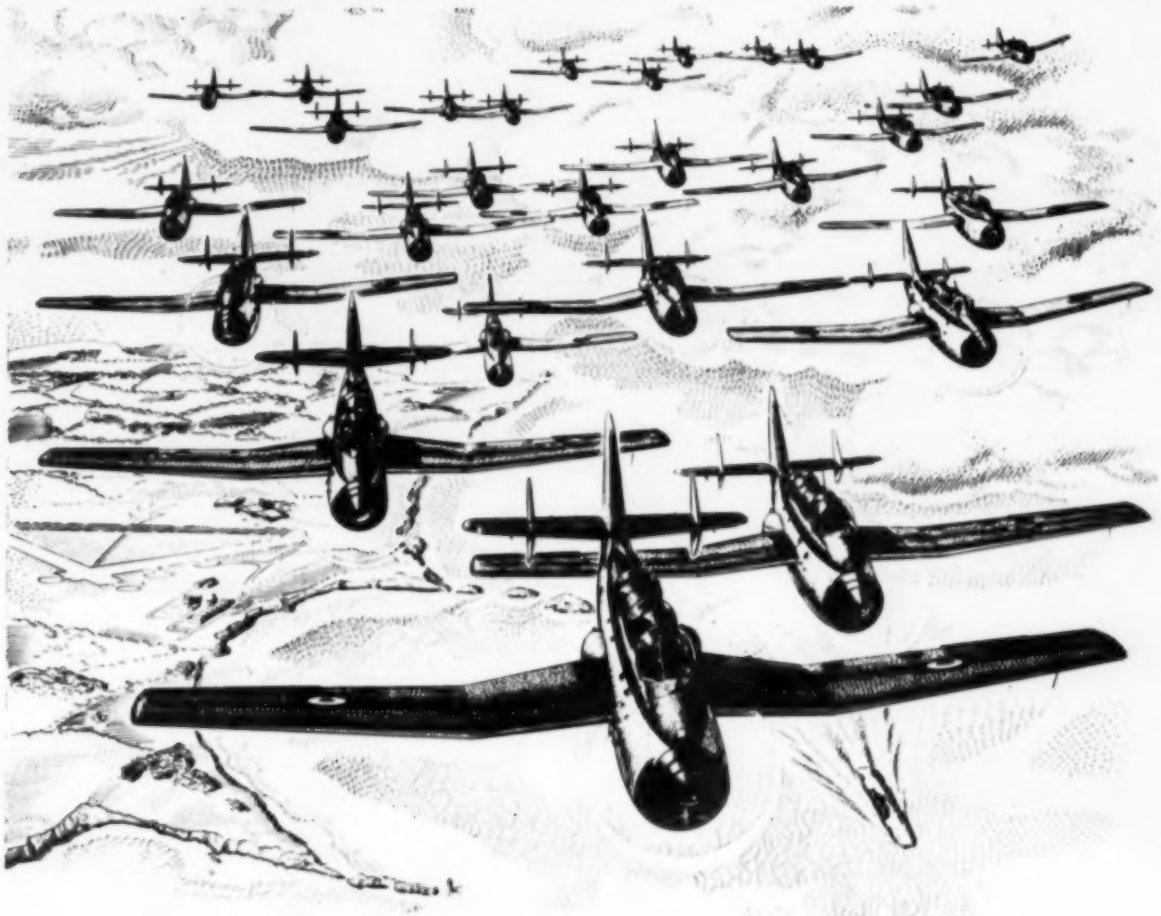
To helicopters, however, the company's resources are principally committed at this time, and it is significant that the considerations which in the first place led Westlands to enter into a licensing agreement with Sikorsky are not by any means restrictive. On the contrary, the company are free to develop, modify, re-engine and otherwise improve basic Sikorsky designs for which they hold the licence, and thus are not compelled to lag behind the American company. In fact, there may on occasions be a return flow of information and, as a result, an even closer understanding based on an exchange of technical experience between the two companies is foreseen.

Current activities and plans for the near future give promise that the name of Westland will figure to an increasing extent in world helicopter affairs. Indeed, though in no sense a matter of policy, the demands which rotating-wing types are making on the company's technical resources may of necessity result in a temporary cessation of fixed-wing work.

The need for helicopter instructional facilities has been largely met by the Westland school, upon which converge the pilots of civil airlines, private operating concerns, and military arms of many nations. Five S-51s are available, and of these two or three are usually in the air, together with Dragonflies and Whirlwinds equipped with trial installations on behalf of the Ministry of Supply. Tuition is necessarily expensive: to purchasers of S-51s the cost is £45 per hour, with the first ten hours free. To non-purchasers the cost is £49 per hour. Buyers of S-55s generally convert to their own machines, but eventually an aircraft of this type may become available for tuition at about £60 an hour.

Production of the S-51 continues, and Westland now have a world franchise, as the production line at Bridgeport is occupied by later and larger models. A quite small but steady demand for the S-51 remains, particularly for use abroad, where a well-

No doubt about the GANNET



- *In Squadron Service in the Royal Navy*
- *In super-priority production—and on programme*
- *Cleared for operation from Light Fleet and Fleet Carriers*
- *Shore-based suitability for coastal approach operations*
- *The practical outcome of unique experience*
- *Officially cleared for full operations at home and abroad*
- *Combines "Search and Strike" operational advantages with twin-engine reliability*

(ARMSTRONG SIDDELEY "DOUBLE MAMBA" TURBO-PROP ENGINE)

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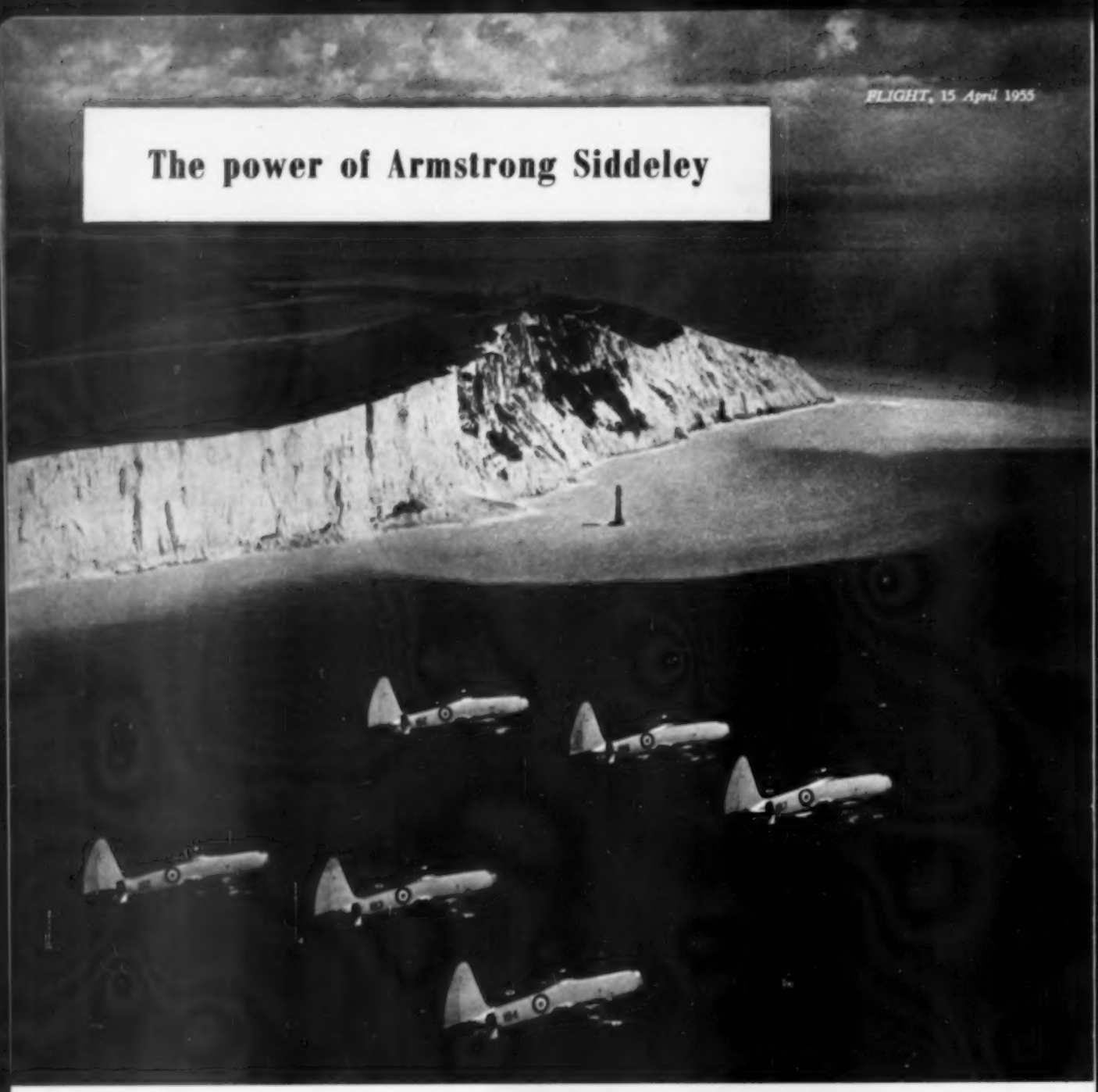
WESTLAND AIRCRAFT

PIONEERS FOR FORTY YEARS

The power of Armstrong Siddeley



Westland Strike Fighters in Squadron Service with the Royal Navy.

The Wyvern is powered by the Armstrong Siddeley Python turboprop—the first turboprop to go into quantity production for military service.

ARMSTRONG SIDDELEY

ARMSTRONG SIDDELEY MOTORS LIMITED · COVENTRY

Members of the Hawker Siddeley Group

Lysander final assembly.

R.A.F. Lysanders dropping supplies in 1940.

WINGS FROM THE WEST . . .

established, reliable vehicle is the paramount need. The life of this design may, in fact, be further extended, and its usefulness increased, by adoption of a later S-55-type rotor head, permitting a greater range of c.g. movement. A modified and lighter cabin has been schemed for use in conjunction with the new head, and this would accommodate the pilot and one extra passenger side by side in the front seats, with three more passengers on the bench-type seat, as at present.

For the S-55, a long and useful life is foreseen, and already one or other of the standard variants of this type is able to meet the requirements for numerous military and civil duties, including anti-submarine work, aerial mine-sweeping and passenger and cargo transport. During next year a prototype will fly with an Alvis Leonides Major engine; and for special duties where twin engines are called for, with ability to fly on one (or where high-altitude and tropical work is in view) a version of the S-55 with Twin Turmo power is planned. The Turmos—basically Turbomécas—are under development singly and in coupled form by Blackburn and General Aircraft at Brough. At low altitudes, and for the same load, the Twin Turmo machine is expected to have a slightly smaller payload than the Leonides Major version.

Final negotiations for the licensing of the S-56 by Westlands have recently taken place, and a general interest in the aircraft has already been indicated by B.E.A. If, in fact, a Westland-built version is developed in this country, it will probably be powered with British gas turbines of the Eland or R.B.109 type. Either of these units would confer a fine single-engine performance, and it would be normal to cruise on one engine with the other shut down. Some slight addition to, or re-arrangement of, the mechanical drive system would probably be necessary in order to ensure an immediate and positive start of the second engine from the rotor in the event of the first one failing.

Although at first glance it would appear that the fuselage of the S-56 would allow of stretch to increase accommodation, this might, in fact, prove to be quite a complicated matter; thus, even with powerful gas turbine engines, the first civil S-56 would probably accommodate no more than 30/32 passengers. Any Westland-built machine of this type is unlikely to be seen in this country before the end of 1958.

Should the even larger S-58 design be taken up, this might, in anglicized form, be powered by Rolls-Royce Darts. For convenience, a shaft-drive might have to be taken from the rear of the engine, but this conversion should not be the major undertaking which might be supposed.

Westlands, however, are not wedded to Sikorsky designs only, and, when circumstances demand, are fully prepared to embark on purely Westland conceptions to meet particular specifications. In the meantime, there is obviously a tremendous advantage in not having to bear development costs on the scale of those habitually accepted in the U.S.A.

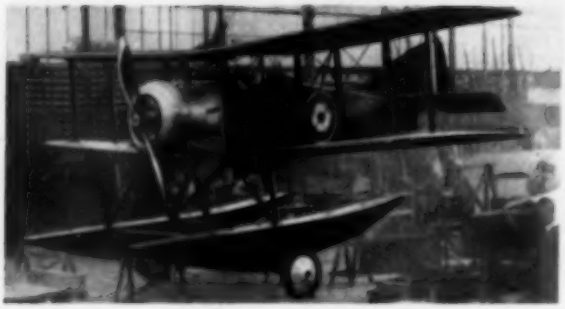
Certainly the Westland design-office will approach whatever tasks may lie ahead with the imagination which has distinguished the company's products over forty years, and which has lately been brought to bear on the problem of jet deflection, entailing the adaptation of a special Nene-engined Gloster Meteor.

We turn now to a more detailed review of the entire family of Westland aircraft, wherein many hitherto unpublished facts have found a place.

Left, Whirlwinds and Lysanders are in production side by side. The adjoining picture shows one of the two R.A.F. Whirlwind squadrons.

Below, a portion of the Dragonfly production line, and (right) Dragonflies in the Queen's Coronation Review of the Fleet of June 1953.

N.16 (Bentley A.R.1)



N.17 (Bentley A.R.1), with long swept-up floats.

Walrus (Napier Lion II).

P.V.3 (Bristol Jupiter XFa).

PART II

THE WESTLAND FAMILY

Wyvern T.F.1 (Rolls-Royce Eagle 22).

FOR THE NAVY

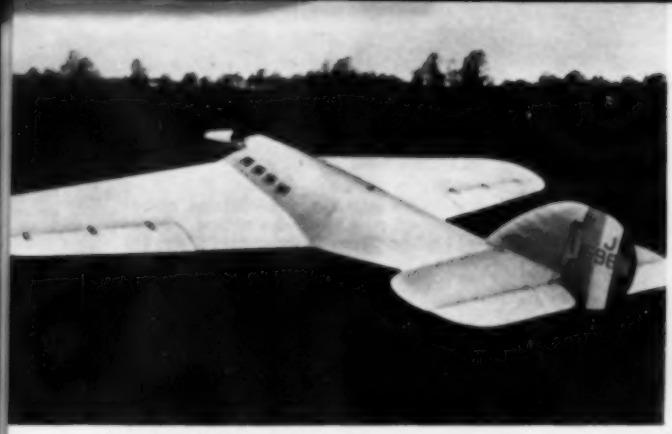
N.16 This neat little twin-float fighter seaplane was the first of the Westland aircraft line and was designed by Mr. Bruce, assisted by Mr. Davenport. It owed its inception to an Admiralty requirement for a fast and handy single-seat shipboard scout, able to carry two 65 lb bombs if required. Armament for fighting duties was one synchronized Vickers gun and one swivel-mounted Lewis gun over the top plane. The engine was a Bentley A.R.1 of 150 h.p., construction was of wood, and variable-camber gear was fitted throughout the span of both wings. Wheels, designed to be jettisoned after the aircraft had left a ship's deck, were attached to the main floats, and there was a skid under the tail float. Test flights were made at the Isle of Grain by Cdr. Seddon. Span was 31ft 3½in, length 26ft 5½in, empty weight 1,460 lb, gross weight 2,133 lb, maximum speed 108 m.p.h., and the climb to 5,000ft took 10 minutes.

N.17 An improved N.16, this machine had no variable-camber gear and the Vickers gun was not faired in. Two types of float undercarriage were fitted, the first having two short main floats and a tail float, as on the N.16, and the second having longer floats, swept up at the rear, and no tail float.

Walrus By name Walrus, but in appearance and by reputation an ugly duckling, this aircraft resulted from an inelegant attempt by the Air Ministry to adapt the handsome D.H.9a bomber for fleet spotting. Provision had to be made for the pilot, a gunner,

Wyvern T.F.2 (Rolls-Royce Clyde). (Below) Wyvern T.3 (Armstrong Siddeley Python).

Wyvern T.F.2 (Armstrong Siddeley Python). (Below) Wyvern S.4 (Armstrong Siddeley Python).



Dreadnought (Napier Lion).

Wagtail (A.B.C. Wasp).

and an observer—the last-named having a prone position beneath the fuselage in addition to his own cockpit. Additional requirements were wing folding; emergency flotation bags (inflated by compressed air); hydrovanes; undercarriage jettisoning; and fuel jettisoning, to allow the empty fuel tank to be used as an additional flotation chamber. Deck-landing gear, in the form of jaws attached to the undercarriage axle, to catch the fore-and-aft wires in use at the time, was incorporated, and the armament was one Vickers and one Lewis gun, the latter on a Scarff mounting. Weight was such that the 450 h.p. Napier Lion II engine was adopted instead of the 400 h.p. Liberty of the D.H.9a; indeed, precious little of the original 9a was to be found in the completed machine. Later in the Walrus's career (36 were built in all) numerous additional modifications were incorporated, including the fitting of high-lift wings, a modified tail unit, and revised ailerons. It is said that the Walrus was not an endearing aircraft to fly, though it is on record that Prince George (later Duke of Kent) was once a passenger in the rearmost cockpit. Walruses were flight-tested by Capt. Keep, the first being flown in 1920. Span was 46ft 2in and length 30ft.

P.V.3 A machine generally similar in character to the Wallace, the P.V.3 was a private venture, designed primarily as a carrier-borne torpedo/bomber, but with army co-operation and general purpose functions also in mind. The wings were arranged to fold, and the undercarriage was of split-axle type and of very wide track (12ft 10in). Construction was similar to that of the Wapiti and Wallace, and the engine was a Bristol Jupiter XFa, geared and supercharged. One Vickers and one Lewis gun were carried, and typical bomb loads were two 550-pounders or four 112-pounders, alternative to a special light torpedo, development of which was later abandoned. Handsome in appearance, the P.V.3 had an excellent performance, the top speed being 163 m.p.h. at 13,000ft, and landing speed only 59 m.p.h. The time of climb to 15,000ft. was only 13.4 minutes and the ceiling was 26,000ft—a factor which led to the adaptation of the aircraft for the Houston-Everest expedition, as later described. Latterly the airframe served as a test-bed for the Pegasus III M.

Wyvern T.F.1 (W.34) The design of the Wyvern arose from Specification N.11/44, calling for a long-range fighter to operate from carriers or shore bases, with particular emphasis on performance at moderate altitudes. The machine was to be capable of alternative operation in the strike role, carrying a torpedo or a heavy load of rocket projectiles or bombs, and naturally came out appreciably larger and heavier than contemporary fighters. Success, therefore, was dependent on a new engine of greater power than was immediately available. Although a turboprop was envisaged for ultimate installation, the 3,500 h.p. Rolls-Royce Eagle 22 twenty-four cylinder H-type piston engine was selected for the Wyvern Mk 1, and for this unit a large Rotol contra-rotating airscrew had to be pioneered. Numerous problems were encountered, affecting the lubrication of the pitch-translation bearing between the two halves of the airscrew, and the stiffness of the long overhanging shaft for the forward screw. These difficulties inevitably had to be contended with during flight-testing of the Wyvern itself, since no other suitable flying test-bed for the Eagle existed. Another problem was the de-stabilizing effect of the massive airscrew, and the stage was reached when this governed the size of the horizontal and vertical components of the tail unit. The first Wyvern T.F.1 was flown by Mr. Penrose on December 16th, 1946. Several prototypes were built and were used for the development of such items as flying controls, which were brought to a very satisfactory state by the use of spring tabs on the ailerons and elevator. In the course of deck trials 100 successful consecutive take-offs and landings were made. Maximum speed was 455 m.p.h. (over four times that of the N.16) and armament was one 20in torpedo or one 2,000 lb bomb, or eight 60 lb R.P.s, in addition to four wing-mounted 20 mm guns. Alternatively there was provision for depth charges or mines. Design features included hydraulically operated Youngman lift flaps, air-brake flaps on the inner wings, and a wide-track, long-stroke undercarriage employing Dowty Liquid-Spring shock absorption. Span was 44ft, length 42ft 3in, and folded width 18ft.

Wyvern T.F.2 This mark was the first of the turboprop versions of the Wyvern, and differed further from the T.F.1 in having a centre and rear fuselage of slightly increased depth, to accommodate the engine tailpipes. Several projected turboprops were considered, but the choice was progressively narrowed down to the Rolls-Royce Clyde and Armstrong Siddeley Python. Eventually, official engine-production policy led to the adoption to the Python alone, although the first prototype was flown with a Clyde (on January 18th, 1949) and after considerable flying by Westland was handed over to the Rolls-Royce experimental establishment at Hucknall. The way of development was not altogether smooth, for the new turboprops had to be harnessed to the very exacting requirements of naval operation, especially in respect of engine-control for deck landing, which conflicted with high-speed response. In this respect the Clyde gave less trouble, but unfortunately was of lower power.

After visiting Yeovil in April, 1952, we wrote in *Flight*:—

"Well aware that modern naval strike fighters must be subjected in action to frequent and violent changes of attitude and power setting, the Westland pilots have deliberately and persistently handled their flying and engine controls in cavalier fashion while diving from high altitude and flying in turbulent air at low level; and in naming these men (Penrose, Bradley and Colvin) we do not forget the less spectacular contribution made by the Armstrong Siddeley and Rotol teams. . . . It must be remembered, moreover, that just as Great Britain did much of the pioneer work in developing the jet fighter, so has she led the way in the application of the turboprop to strike aircraft; and the Wyvern is the expression of her advanced thinking in this regard."

The first Python-powered Wyvern T.F.2 was flown on March 22nd, 1949.

Wyvern T.3 A two-seat dual-control version of the T.F.2, this trainer was first flown on February 11th, 1950. The instructor was at the rear and both cockpits were fitted with ejector seats. A periscopic mirror was built into a streamlined fairing between the two enclosures so that the instructor could see clear ahead and downwards at a relatively steep angle. Only one T.3 was built, and this was lost through engine failure.

Wyvern S.4 The first version of the Wyvern to enter service with the Fleet Air Arm, this model is characterized by a "cut-back" engine cowling, to facilitate the loading of the starter cartridges; a "spear-tipped" Rotol airscrew; stiffer canopy; small fences on the trailing edge (these were fitted to prevent the slight tug on the ailerons formerly experienced when the dive brakes were closed); modified aileron tabs; an even taller fin and rudder, with horn balance; and a dihedral tailplane, now fitted with two small auxiliary fins. The Armstrong Siddeley Python 3 has a take-off rating of 3,670 shaft horse-power plus 1,180 lb jet thrust. Total fuel capacity is 511 gallons, and provision is made for two external drop tanks, each holding 90 gallons.

STRICTLY ONE-OFF

Dreadnought Postal Monoplane In conformity with the ideas of a Russian, M. Voyevodsky, and to the order of the Air Ministry's Directorate of Technical Development, Westlands built, during 1923, the Dreadnought monoplane, supposedly intended for "postal" service. The Voyevodsky theory advocated a "continuous aerofoil"—that is, a cantilever monoplane wing merging with the fuselage—and among the models tested before the actual full-scale machine was constructed was one of a twin-engined freighter with a retractable undercarriage. The Dreadnought itself had a Napier Lion engine and a fixed undercarriage, and was of startlingly advanced appearance, as the picture shows. The wing had five tubular multi-spars, with wooden ribs and fabric covering, and the fuselage, except for the deepened wing-

Weasel (A.B.C. Dragonfly).

Westbury (two Bristol Jupiter VI).

Wizard I (Rolls-Royce F.XIA).

Wizard II (Rolls-Royce F.XIS).

F.20/27 (Bristol Mercury IIA). (Below) F.29/27 (Bristol Mercury IIIA).

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roots, was of wood. For the wing-root/cabin portion corrugated metal skinning was applied over metal channelling.

Early in May 1923, with Capt. Keep at the controls, the big monoplane left the ground for the first time; but as it drew near to the factory it was apparent that the pilot was having difficulty in opposing an excessive nose-up trim. Almost immediately the Dreadnought stalled, and crashed from a height of about 100ft. Capt. Keep sustained injuries which necessitated amputation of both his legs. Undaunted, he served the company for many years afterwards as a senior executive.

LAND FIGHTERS

Wagtail There were five of these trim, bantam-weight fighters. The first was flown early one morning in 1918, and the pilot, Capt. Alexander, was so favourably impressed that he looped it forthwith. One of the smallest fighters ever built, the Wagtail had a span of only 23ft 2in, a length of barely 19ft, a gross weight of 1,330 lb, and an armament of two fixed Vickers guns with 1,000 rounds of ammunition. Oxygen was provided, in view of the intended role of high-altitude fighting and reconnaissance. The original engine was the troublesome 170 h.p. A.B.C. Wasp, but in the early 1920s an Armstrong Siddeley Lynx was installed experimentally. With the Wasp a speed of 125 m.p.h. was attained at 10,000ft, and the climb to 17,000ft took only 17 minutes—a remarkable performance in those days. Landing speed was 50 m.p.h.

Weasel The Weasel was a two-seater fighter, of which four examples were built. An A.B.C. Dragonfly engine was specified but, as with the Wasp of the same make, serious troubles were encountered, and these inevitably proved a setback to the Weasel's development. After the war the Armstrong Siddeley Jaguar and Bristol Jupiter II were installed experimentally, and Weasels powered with these engines appeared at the R.A.F. Pageant of 1923. Armament was heavier than on the Bristol Fighter, which the Weasel was intended to succeed in the two-seater fighter category, in that the pilot had two synchronized Vickers guns instead of one; at the rear was a single Lewis gun on a Scarff mounting. Oxygen equipment and electrical heating apparatus was provided, and the tailplane was adjustable. The span was 35ft 6in, length 24ft 10in, and gross weight 3,046 lb.

Westbury Specification 4/24 called for a twin-engined fighter carrying two 37 mm Coventry Ordnance Works guns, firing 1½-pounder shells at the rate of 100 rounds a minute, and to meet this requirement Westlands built two examples of the Westbury, one of which had wooden wings and the second, wings with duralumin spars and wooden ribs. The first was initially tested by Capt. Frank Courtney and the second by Major Openshaw.

A three-bay machine, the Westbury had two Bristol Jupiter VI engines set on the lower wing. The pilot's cockpit was ahead of the upper wing, and there was provision for a 37 mm gun in the nose and for one in a dorsal position. The forward "cow gun" was emplaced on a special Westland-developed mounting (the rights for which were subsequently sold to Vickers-Armstrongs, Ltd.) and was traversed by means of a handwheel. The mounting was self-locking in any position and had a pedal-operated brake. The second gun was fixed to fire forward over the top centre-section, and during tests the muzzle blast from this piece of ordnance proved so violent that a specially sprung metal shield had to be fitted for protection of the wing. Special interchangeable deck fairings were provided so that a standard Scarff mounting, with Lewis gun, could be carried in the dorsal position instead of the "cow gun". The Westbury handled well with one engine cut and (observed *Flight*) could actually be quite easily turned against the running engine. Data were: span 68ft, length 43ft 5in, weight empty 4,845 lb, gross weight 7,877 lb, speed at 10,000ft 122 m.p.h., climb to 10,000ft 10 min, service ceiling 21,000ft.

Wizard I The virtues of the parasol wing, clearly manifest in the Widgeon light aircraft, led Westlands to design a private-venture single-seat fighter along similar lines. The engine was a Rolls-Royce Falcon III, the cylinders of which were left uncowled, and there was no spinner forward of the blunt nose. Wooden construction was initially used throughout, but after a forced-landing accident the machine was rebuilt with a tubular metal fuselage; at the same time, one of the early, unsupercharged Rolls-Royce "F" engines was fitted and various refinements incorporated. The resulting aircraft—officially known as the Wizard Mk I—was first tested by Capt. Louis Paget, and was of strikingly elegant appearance. A speed of 188 m.p.h. was realized at 10,000ft, at which height the rate of climb was little short of 2,000ft/min. Gross weight was 3,326 lb and wing loading 14 lb/sq ft. Design features included a retractable radiator and low-set, fuselage-mounted twin Vickers guns. The Wizard I gave a flashing demonstration at the R.A.F. Display of 1928.

Whirlwind I (two Rolls-Royce Peregrine).

F.7/30 (Rolls-Royce Goshawk VIII).

Wizard II Whereas the Wizard I had no true centre-section (the mainplane being carried above the fuselage on two struts in tandem), this remodelled version had a centre-section supported on four splayed-out struts. With the object of improving the pilot's view, a large "bite" was removed from the trailing edge, whereas formerly there was a mere "nick." The wing, as well as the fuselage, was of metal, and the engine was a supercharged Rolls-Royce F.XIS.

F.20/27 To the F.20/27 intercepter specification Westlands put up a wire-braced, low-wing monoplane, first test-flown early in 1929 by F/L. Paget. The original engine was a Bristol Mercury IIA, but this was later replaced by a Jupiter VII. It was officially reported that the machine "behaved curiously" in tight turns and loops, and at high incidences the tail vibrated and longitudinal control was impaired. Modifications were thereafter made to the wing/fuselage fillets, and in the design of the tail surfaces. A wealth of valuable experience accrued. The twin Vickers guns were heated by engine exhaust and were wholly submerged in the fuselage, firing out through ports ahead of the cylinders. A cockpit door facilitated entry and exit. The F.20/27 had the additional distinction of being one of the first British fighters to be fitted with wheel brakes—of the Bendix Perrot type. Construction was of metal throughout. Span and length were, respectively, 38ft and 25ft 4in, and the loaded weight was 3,325 lb.

F.29/27 This fighter was first test-flown, by F/L. Paget, in 1931. Though superficially resembling the F.20/27, it had a longer fuselage, a slightly back-swept wing of increased span, and—of far greater interest—a 37 mm Coventry Ordnance Works gun, fixed in the port side of the fuselage to fire upwards and forwards. The breech of this gun was in the cockpit and was accessible to the pilot; either semi-automatic or single-shot fire was possible, and it was intended that the gun should fire high-explosive shells against massed heavy bombers, for which purpose a special sight was developed. An Air Staff decision led to cancellation of the project, though as a flying machine the F.29/27 was quite successful. Span was 40ft 10in, length 29ft 10in, empty weight 2,615 lb, gross weight 3,885 lb, top speed 184.5 m.p.h. at 13,000ft, time of climb to 20,000ft 14.3 minutes, and absolute ceiling 29,200ft. The engine was a Bristol Mercury IIIA.

F.7/30 This unorthodox single-seat, four-gun fighter was first flown, by Harald Penrose, in 1934. The pilot's cockpit was enclosed and, with the object of affording the widest possible range of vision, was placed ahead of the wings. The Rolls-Royce Goshawk VIII steam-cooled engine was mounted amidships, and drove the airscrew by means of a shaft. The four Vickers guns were mounted in the sides of the fuselage, ahead of the engine, and being designed to a day-and-night fighter specification, the aircraft carried two-way radio, night-flying gear and oxygen. Construction was all-metal, with fabric covering, and—unusual in a single-seat fighter of the period—Handley Page automatic slots were fitted. The undercarriage was of faired split-axle type, and the steam condenser was mounted ventrally. Span was 38ft 6in, length 29ft 6in, weight empty 3,624 lb, gross weight 5,170 lb, speed 185 m.p.h. at 15,000ft, and the climb to 20,000ft took 17½ minutes.

Whirlwind I Designed by Mr. W. E. W. Petter to Specification F.37/35, the Whirlwind twin-engined single-seat fighter was first flown by Mr. Penrose on October 11th, 1938. The two Rolls-Royce Peregrine engines, each delivering 885 h.p. at 15,000ft, gave a maximum speed of 360 m.p.h. at that height, which the Whirlwind could attain in 5.8 minutes. The four 20 mm guns were closely grouped in the nose, giving a very dense concentration of fire, and the coolant radiators were ducted within the centre-section of the wing. Fowler flaps extended from aileron to aileron, and although Handley Page slots were fitted, these were eventually locked shut, on the discovery that behaviour at the stall was entirely adequate without their aid. Landing speed rose by a few m.p.h. The Whirlwind had the distinction of being the first Westland fighter—and, in fact, the first twin-engined fighter—to be used by the R.A.F. Equipped to carry two 500 lb bombs it was dubbed the Whirlibomber; indeed, the type will be remembered principally for its ground-attack and dive-bombing activities, though night fighting and bomber escort also fell to its lot. Span was 45ft, length 32ft 9in, weight empty 7,840 lb, gross weight 10,270 lb. Including the two prototypes, 116 Whirlwinds were built.

Welkin I A big brother to the Whirlwind, the Welkin I was a specialized ultra-high-altitude intercepter fighter, built to Specification F.4/40. It was characterized by a high-aspect wing of inordinately large span (70ft), by twin two-stage-supercharged Rolls-Royce Merlin engines, and a pressure cabin consisting of

Welkin I (two Rolls-Royce Merlin 70 series).
(Below) Welkin II (Rolls-Royce Merlin 76 and 77).

(Left) Yeovil (Rolls-Royce Condor).
(Below) Witch (Bristol Jupiter VIII).

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a self-contained unit of very-heavy-gauge bullet-resisting light alloy. The cabin unit was bolted to the front face of the main spar, had an armoured steel bulkhead at the rear and a second bulkhead in the nose. The sliding canopy was of sandwich construction, the inner shell retaining the pressure and the outer shell merely acting as a fairing and allowing a space through which warm air could be circulated to prevent misting and icing. A Westland control valve regulated cabin pressure to a differential of 3.5 lb/sq in; air was supplied by a Rotol cabin supercharger driven by the port engine. Fowler-type flaps were fitted and four 20 mm guns were grouped in the fuselage nose. The standard power installation was a Merlin 72 or 76 in the starboard nacelle, and a 73 or 77 in the port nacelle, but one experimental Welkin was fitted with RM16SM engines, with "beard" radiators instead of the normal centre-section installations. This special version, incidentally, was somewhat faster than standard, having a top speed of 398 m.p.h. at 30,000ft. The Welkin I was 41ft 6in long and had a wing area of 460 sq ft. Gross weight was 17,500 lb, maximum speed 387 m.p.h. at 26,000ft (358 m.p.h. at 40,000ft), maximum rate of climb 3,850ft/min, and the climb to 40,000ft, at combat rating, took 18 minutes.

Welkin II Only one example of this two-seater development of the Welkin I was built, and this was demonstrated in the S.B.A.C. Display of 1946. The principal differences were the fitting of a longer nose, housing A.I. radar for night fighting, the moving forward of the pilot, and the incorporation of a rearward-facing observer's seat. The front windscreen was lowered and the dihedral angle of the outer sections of the wings was increased. One engine was a Rolls-Royce Merlin 76, the other a 77. Gross weight was 21,892 lb, maximum speed 360 m.p.h. at 30,000ft, and operational ceiling 37,700ft.

BOMBERS

Yeovil The Yeovil was a two-seat-bomber biplane, conforming to Air Ministry Specification 26/23. Of the three prototypes, the first was test-flown at Andover in the summer of 1925 by Capt. Courtney, though development testing was later the responsibility of Major Openshaw. Various differences were to be observed between the three Yeovils, notably that the first originally had undercarriage and tankage arrangements differing from those adopted subsequently. With its span of 59ft 6in and an all-up weight which rose from the mid-7,000s to over 8,000 lb, the Yeovil was a comparatively heavy machine, but with the specified engine—the 650 h.p. Rolls-Royce Condor—a very useful performance was attained, the maximum speed being 120 m.p.h. The forward section of the fuselage was of steel tubular construction, but the central part was of wood, as was the rearmost portion. The wings, too, were of wood, but metal construction was used for ailerons, elevators and rudder. Provision was made for a single 520 lb bomb or a variety of bombs of lesser weight, and the gun armament was a synchronized Vickers and a Scarff-mounted Lewis at the rear. The specification also called for radio and oxygen equipment. Although the Hawker Horsley was victorious in the 26/23 competition, the Yeovils proved themselves to be fine machines and were extensively used for development flying. Tests were conducted, for example, with the Leitner-Watts hollow-bladed metal airscrew and with the Gloster-Hele-Shaw-Beacham adjustable-pitch airscrew.

Witch First flown in 1928, by F/L. Paget, the Witch was designed to meet Air Ministry Specification 23/25, which called for a single-engined high-altitude day bomber, capable of operating alternatively as a coastal-defence torpedo bomber. Unlike its rivals, the Hawker Harrier, Handley Page Hare, and Blackburn Beagle, which were biplanes, it was a parasol-wing monoplane. Of composite (wood and metal) construction, it had a wide-track split undercarriage, and was armed with a forward-firing Vickers gun on the port side of the fuselage, and a Scarff-mounted Lewis gun. The bomb load, which could be in the form of a single 520-pounder, was carried internally and was released through spring-loaded trap-doors, which opened under the weight of the bomb(s). A Jupiter VIII engine—a geared unit of the type which was to render good service in Wapitis—was fitted. Span, length and wing area were, respectively, 61ft, 37ft 8in, and 534 sq ft; the empty weight was 3,380 lb (a notably low figure, having regard to the monoplane layout), gross weight was 6,050 lb, and top speed 139.5 m.p.h. at 5,000ft.

The specification having been abandoned, the one-and-only Witch was delivered to Henlow, where it served for the testing of parachutes and parachute training.

FOR GENERAL PURPOSES

Wapiti (Prototype) It was recognized, in the later 1920s, that a replacement for the D.H.9a—the standard "general-purpose" aircraft of the R.A.F. since 1918—was becoming a pressing need, and an Air Ministry competition was initiated accordingly. The desired replacement aircraft was to incorporate as many parts of the "Nine-Ack" as possible, and entries by Armstrong Whitworth, Bristol, de Havilland, Fairey, Gloster, Vickers and Westland conforming to this requirement in varying degrees, were tested at Martlesham Heath.

The Wapiti, as the Westland entry was named, had a Bristol Jupiter VI engine, and the fuselage was 12in deeper and 5½in wider than that of the D.H.9a. Wings, struts and tail unit were essentially standard 9a components; the front portion of the fuselage was of duralumin tubes, covered with aluminium and the rear portion was of wooden construction. Relative to their situation in competitive designs, the pilot and gunner were placed quite far aft, in consequence of which the cut-out in the top trailing edge was quite small. This was a considerable factor, it was thought, in maintaining aerodynamic efficiency. The first test flight was made early in 1927, by Major Openshaw, and it was quickly discovered that revision of the fuselage had rendered the standard D.H.9a rudder ineffective. A larger rudder was thereupon installed, and with this fitted the Wapiti prototype appeared in the R.A.F. Display of 1927. After lengthy competitive tests the Wapiti was officially adopted as the new standard R.A.F. general-purpose machine during 1928. Ultimate total production of Wapitis was 565, including 517 for the Air Ministry, 38 for Australia, 4 for South Africa, and 4 for China.

Four ex-R.A.F. Wapitis were supplied to the Kingdom of the Hejaz and a few reconditioned R.A.F. Wapitis went to Canada. Of the Canadian machines, six were still flying as late as 1939. Wapitis were used for numerous experimental purposes additional to those mentioned hereafter. One, for instance, had a Townend ring over its Jupiter VIII engine, thereby gaining 10 m.p.h. in maximum speed. Another was used for the testing of Leitner-Watts metal airscrews.

Wapiti I This first production version of the Wapiti had a front fuselage of square-section duralumin tubes, wooden rear fuselage, wooden wings and centre-section, and a wooden tail unit—except the rudder, which was metal. The major portion of the front fuselage was covered with aluminium and there were other differences in ailerons and undercarriage. The large fin-and-rudder assembly used was characteristic of all later Wapitis.

Wapiti Ia This designation related to the Wapiti I as fitted with a geared Jupiter VIII engine in place of the direct-drive Jupiter VI and having increased stagger. The type was supplied to the Royal Australian Air Force.

Wapiti Ib As Wapiti Ia, but with split-axle undercarriage. Supplied to the South African Government. The Jupiter VIIIF

Wapiti prototype (Bristol Jupiter VI).

Wapiti II (Bristol Jupiter VI).

engine was originally fitted, but was later replaced—in South Africa—by the Armstrong Siddeley Panther. One of the S.A.A.F. machines was fitted with an enclosed rear cockpit and was used by the South African Civil Air Board.

Wapiti II An all-metal version of the Wapiti, fitted with a direct-drive Jupiter VI engine and widely used in the R.A.F. by Regular and Auxiliary squadrons. Front and rear fuselage were of square-section duralumin tube, and the mainplanes were designed and manufactured by the Steel Wing Co., Ltd., a subsidiary of Gloster Aircraft, Ltd. (Towards the end of the Wapiti contracts the metal wings and interplane struts were being made by Westland, to the Steel Wing Company's designs.) The ailerons, centre-section, tailplane, elevator, fin and rudder were mainly of duralumin, the ribs being dural pressings. Span was 46ft 5in, length 31ft 8in, height 11ft 10in, wing area 488 sq ft, empty weight 2,644 lb, gross weight 4,240 (4,838 lb with overload), maximum speed 133 m.p.h. at 5,000ft, service ceiling 22,700ft.

Wapiti IIa Extensively used by the R.A.F. overseas, the Wapiti IIa was employed both as a general purpose aircraft and—to a lesser extent—on army co-operation duties. As used by the R.A.F., it had a Jupiter VIII, VIIIF, or XFa, but a Jupiter XIF was installed experimentally. With the Jupiter VIII, and flying at the normal gross weight of 4,900 lb, the maximum speed was 142 m.p.h. at 5,000ft. Normal range was 500 miles, but this could be increased to 620 miles by fitting an auxiliary tank beneath the fuselage. Landing speed was 58 m.p.h. and stalling speed (engine on) a mere 42 m.p.h. Armament, as on earlier marks, was a synchronized Vickers gun, mounted outside the fuselage to port, and a Lewis gun on a Scarff ring. Provision was made under the wings for bomb loads up to 580 lb. A split-axle wheel undercarriage, floats or skis could be fitted in place of the normal cross-axle undercarriage, as standardized on R.A.F. production machines. Goodyear "airwheels" were fitted to a number of Wapiti IIas in R.A.F. service overseas.

Wapiti III There is no record of the sub-type to which this mark number was allocated. Possibly it applied to the Jaguar-engined Wapiti with split-axle undercarriage, one example of which was supplied to the Air Ministry in 1929.

Wapiti IV During 1931 a Wapiti IV, characterized by an Armstrong Siddeley Jaguar VI engine, a fuselage lengthened by 2ft, and a split undercarriage, was demonstrated to the Central Chinese Government.

(Above) Long-fuselage Wapiti with experimental airscrew.
(Right) Wapiti IIa seaplane (Bristol Jupiter VIII).

(Above) Long-fuselage Wapiti (Armstrong Siddeley Panther).
(Below) Wapiti with Bristol Phoenix engine.

Wapiti V In one form, at least, the Wapiti V had an Armstrong Siddeley Panther engine, a long fuselage as on the Mk IV, and a strengthened cross-axle undercarriage, with brakes. Early in 1931 it was demonstrated by Mr. Penrose in Argentina and Uruguay, in connection with the British Empire Exhibition at Buenos Aires. The same designation apparently applied to the single long-fuselage Wapiti supplied to the Air Ministry and adapted for general purpose and army co-operation duties. The lengthened fuselage gave the necessary wide c.g. travel to meet varying conditions of loading, and conferred a greater measure of fore-and-aft control near the ground. Other innovations were a rudder of deeper chord, a strengthened undercarriage, with wheel brakes, and a tailwheel. This Wapiti was exhibited in the "New and Experimental" park at the R.A.F. Display of 1930, and for a period was fitted with the Bristol Draco direct-injection engine and an experimental four-blade magnesium-alloy airscrew.

Wapiti VI There is no record of the sub-type to which this mark number was allocated.

Wapiti VII This was the original designation of the P.V.6, or Wallace, later described.

Wapiti VIII The Mk VIII Wapiti was a Panther-engined variant, similar to the Mk V, but with a split-axle undercarriage.

Wapiti (Bristol Phoenix) A Wapiti I airframe, first adapted as a flying test bed for the Bristol Phoenix I compressed-ignition air-cooled engine, was later fitted with a moderately supercharged Phoenix II. With this engine, and piloted by Harald Penrose, it

(Left) Wallace I prototype (Bristol Pegasus IM3).

(Below) Wallace II (Bristol Pegasus IM3) and P.V.7 (Bristol Pegasus IIM3).

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attained a height of 28,000ft—a record for a diesel-engined aircraft. At ceiling, Mr. Penrose reported, there was little sign of failure to burn the fuel properly. Special precautions had to be taken to avoid excessive cooling of the oil, and the tank was covered with felt. Mr. Penrose himself used oxygen gear with electric heating, to prevent moisture in the oxygen from freezing at the reducing valve.

Wapiti (Bristol Pegasus) The records of the engine division of the Bristol Aeroplane Company, Ltd., show that Wapiti prototype J8495 was used as a test-bed for the Pegasus I.

Wapiti (T) This was the designation of the Wapiti dual-control trainer (Jupiter VI) supplied in small numbers to the Air Ministry. No armament was fitted.

Wapiti (for H.R.H. the Prince of Wales) A Jupiter VI-engined Wapiti I, resembling in appearance the Wapiti (T), was used by the Prince of Wales as his personal aircraft. A similar machine was built to act as escort.

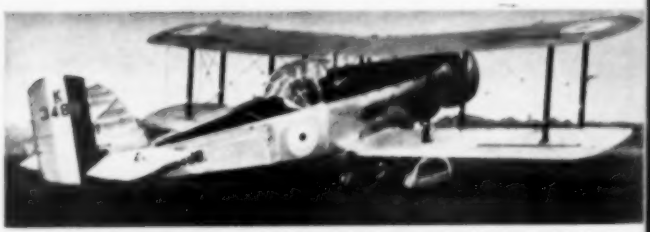
Wallace I (P.V.6) Early in 1932 Westland were able to announce a new, private-venture, general-purpose aircraft, developed from the Wapiti and known at the time as the P.V.6. It was a conversion of the actual Panther-engined Wapiti V which Mr. Penrose had demonstrated in South America during 1931, and the engine was one of the earliest of the Bristol Pegasus moderately supercharged series. (Later this same aircraft was converted for the Houston Everest expedition, as described under "Conquerors of Everest.")

The power of the Pegasus engine and a general cleaning up of the airframe resulted in a most attractive performance, the maximum speed being nearly 160 m.p.h. Among other items, the cleaning-up process involved the curving of the fuselage side-fairings so as to house the fixed machine gun, as well as the elevator control cranks and cables. The sides of the forward fuselage were in the form of detachable panels, giving an unprecedented degree of accessibility, and the rearmost (fabric-covered) portion was fitted with zipp fasteners so that this, too, could be easily inspected. The undercarriage was of the split type, with wheel brakes, and a tailwheel supplanted the skid normally fitted to the Wapiti. Wings, struts, centre-section and tail surfaces were all Wapiti components. The first Air Ministry order for the Wallace entailed the conversion of twelve Wapitis, but later Wallaces were built "from scratch." In all Westland turned out 113 machines of the type (Mks I and II). The engine of the Wallace I in R.A.F. service was the Pegasus IM3.

Wallace II Like the Wallace I, the Mk II was used by the R.A.F. It differed from the former mark in having a complete system of cockpit protection, the pilot being enclosed by a three-sided sliding coupé top and the observer by a "lobster-tail" folding canopy. The rear Lewis gun was stowed in a trough in the fuselage decking. For entry and egress on the ground (or, should he wish, when flying) the pilot could slide the whole coupé top forwards; additionally there was an emergency central division which, when operated, allowed the two halves of the coupé, when in any position, to fall outwards, facilitating exit with a parachute. Effect of the enclosure on performance and control was negligible.

Wallace (Target Tug) A few Wallaces were converted for service as R.A.F. target-towers. The cable-winch lay across the top longerons.

P.V.7 This high-wing monoplane was a private venture to Air Ministry Specification G.4/31, which called for a general-purpose aircraft capable of discharging all the duties which had previously fallen to the Wapiti and others of its class, but capable also of operating as a torpedo dropper or with a 1,000 lb bomb. The engine was a Bristol Pegasus IIM3 (later IIIM3), the span 60ft 3in, length 38ft, wing area 537 sq ft, weight empty 4,515 lb, weight loaded 7,172 lb, and maximum speed 173 m.p.h. at 5,000ft. Metal construction was used throughout, and the wings were fitted with Westland "electroscope" split trailing-edge flaps which acted as air brakes for dive bombing. Both pilot and gunner were protected by enclosures, and, being seated forward of the wing, the pilot was afforded a fine view for diving attacks. It was during overload diving tests at Martlesham Heath that Harald Penrose met with an unenviable experience which he recalls on a later page.



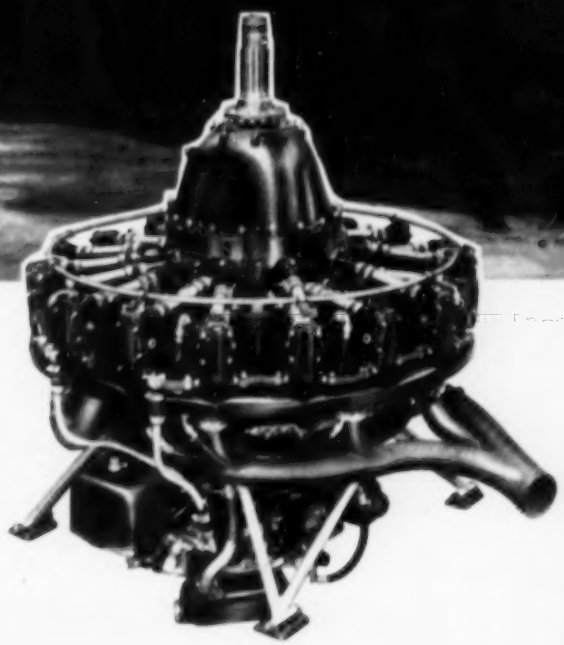
CONQUERORS OF EVEREST

Houston-Westland (Converted P.V.3) For the Houston Mount Everest Expedition of 1932/33 two aircraft, with an operating ceiling of at least 33,000ft, were required. In the book *First Over Everest*, the authoritative account of the expedition, it is stated:—

"The selection of the aeroplanes was by no means easy, having regard to the prominent part played by the engine. At first sight it would seem that an engine like the Pegasus would pull almost any well-designed modern aeroplane of suitable characteristics to the immense height called for by the task. Investigation proved that there were not many aeroplanes suitable for the flight. Naturally, the machine had to be a two-seater. . . . Then again otherwise suitable aeroplanes were inadmissible owing to low undercarriages. Our machine must have a propeller of unusual diameter in order to grip the thin air, and we had to foresee the possibility of taking off from aerodromes covered with sand, gravel or small stones. Should the propeller tips come too near the ground, there was danger of their being damaged from flying fragments. . . . Even with all these points suitably adjusted, it was as well to have a machine with a deep and broad fuselage in which the observer could handle his numerous cameras without becoming hopelessly congested. Our final choice rested on the Westland P.V.3, which we never regretted."

The engine installed was the highly supercharged Bristol

CONGRATULATIONS TO WESTLAND AIRCRAFT



The outstanding record in the Royal Navy of the Westland-Sikorsky Dragonfly powered with the ALVIS Leonides Engine, is a tribute to the close association that has marked the parallel achievement of our two companies in the development of British helicopters.

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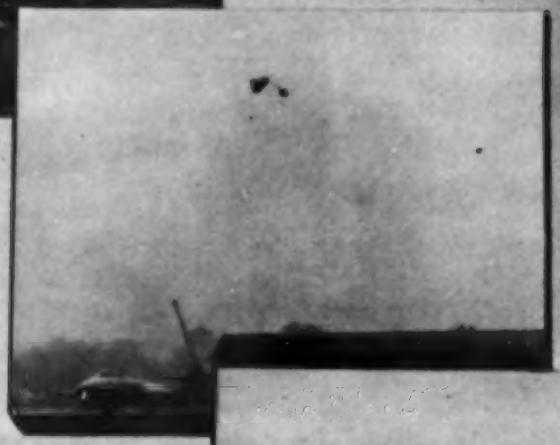


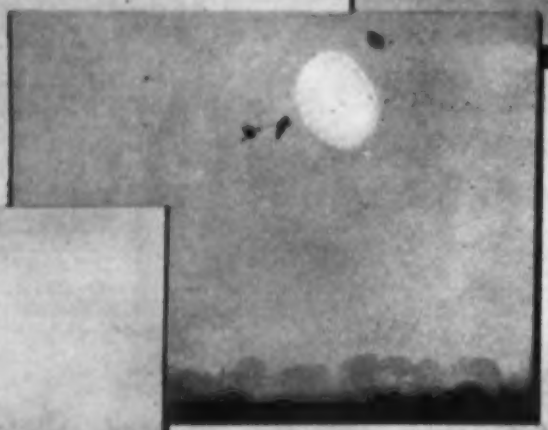
Martin–Baker

AIRCRAFT COMPANY LIMITED

These photographs show an actual ejection on the run-way. The aircraft is taking off at 120 knots.

This test was carried out with the 80 feet per second long stroke ejection gun. No other ejection seat in the world is capable of such a performance.

All design features patented in the principal countries of the world.



THE WESTLAND FAMILY . . .

Pegasus IS3. The aircraft was lightened as much as possible, a process involving deletion of the wheel brakes and wheel fairings, and substitution of a tail skid for the existing tailwheel. The observer's cockpit was faired in to give protection, and springs were incorporated in the controls to compensate for unequal contraction of metals at great altitudes.

Early in 1933 final tests were made by Mr. Penrose, who ascended to a height of 37,500ft, and on April 3rd, piloted by Lord Clydesdale and with Lt-Col. L. V. S. Blacker as observer, the Houston-Westland, in company with the special Wallace mentioned below, accomplished the historic flight over the great mountain.

Eventually the P.V.3 came home to Yeovil, and thereafter served out its days as a flying test bed for Bristol engines.

Wallace (Everest Conversion) As a second string for the Houston Everest Expedition, the original Wallace was fitted with a Pegasus IS3 engine, was lightened in the manner described for the Houston-Westland, and the rear cockpit was faired in. For the actual assault, the pilot was F/L. D. F. McIntyre, now managing director of Scottish Aviation, Ltd., who carried as passenger Mr. S. R. Bonnett, a Gaumont-British photographer.

Houston-Westland (Bristol Pegasus IS3).

Wallace (Everest conversion) (Bristol Pegasus IS3).

THE PTERODACTYLS

The story of the early development of the Pterodactyl series of tailless aircraft was told in detail by Capt. (now Professor) G. T. R. Hill, the designer of these machines, in a paper before the Royal Aeronautical Society during April 1926. In that paper Capt. Hill said: —

"I thought about safety in flight, in particular about what may be termed 'aerodynamic safety,' by which I mean the freedom from accident caused through lack of control. Being faced with the fact that about fifty lives were being, and I believe are still being, lost in the Royal Air Force every year, and that a large proportion of the accidents are due to a loss of control in the air, I set myself to try to design an aeroplane which would never, through an error on the part of the pilot, get out of control. . . ."

The first Pterodactyl—the Mk I—was built by Capt. Hill himself. First flown as a glider, in 1924, it was later fitted with a Bristol Cherub engine of 32 h.p. and was flown under power at Farnborough in November 1925. Later, development was taken over by the Westland works and Capt. Hill joined the company's staff. The first Westland-Hill Pterodactyl was the Mk. Ia, described below.

Pterodactyl Mk Ia This mark of Pterodactyl was a side-by-side two-seater, originally having a Bristol Cherub engine of 32 h.p. and later an Armstrong Siddeley Genet (75 h.p.). "Controllers," acting as ailerons and elevators, were fitted at the wing-tip, as on the original machine, and rudder effect was produced by inboard flaps, which could be operated together, "electroscope" fashion, to serve as airbrakes. The monocoque fuselage had two skins of spruce strips, applied diagonally over ash rings. There was a single central main wheel, with springing inside the fuselage, and two outrigger wheels, carried behind the trailing edges of the wings and fitted with brakes connected to the rudder flaps above them. The Pterodactyl Mk Ia was a favourite performer at the R.A.F. Display, where it appeared, in the year 1930, in formation with an early Autogiro and a Handley Page Gugnunc. Span was 45ft 6in, length 17ft, wing area 200 sq ft, gross weight (Cherub) 900 lb, gross weight (Genet) 1,300 lb.

Pterodactyl Mk Ib This was the Ia (Genet) with a tandem-wheel undercarriage in place of that originally described.

Pterodactyl Mk IV A three-seater cabin machine, powered with a de Havilland Gipsy III engine, this type was built in 1931 with the object of attaining a higher degree of safety, comfort and performance than was possible with aircraft of conventional type. The swept-back wings were washed out in incidence towards the tips and set at a small negative dihedral angle. Fore-and-aft and lateral control was achieved through the medium of wing-tip "controllers," capable of being moved to large negative angles, and steering was effected originally with horizontal "electroscope" flaps, and later by single-acting vertical wing-tip rudders, used separately. Both rudders could be operated simultaneously to function as air brakes. The Gipsy III was completely cowled and cooling air was sucked by the propeller through a special duct. Provision was made for sweeping the wings forwards or backwards, on the ground or in flight, through a range of 4½ deg, and by this means the aircraft could be trimmed for wide variations in load at all speeds. The tandem-wheel undercarriage was of the type developed on the Pterodactyl Ib, the wheels being mounted on a rocking frame, which permitted easy riding over rough ground.

The first tests of the Pterodactyl Mk IV were made by F/L. Paget, but development was continued by F/L. Brunton and Mr. Penrose. Aerobatics were frequently performed, and the machine was extensively spun, first by F/L. G. H. Stainforth and subsequently by Mr. Penrose.

Span was 44ft 4in, length 19ft 6in, wing section R.A.F.34, wing area 259 sq ft, weight empty 1,320 lb, weight loaded 2,100 lb, top speed 113 m.p.h., landing speed 54 m.p.h., initial rate of climb 760 ft/min, and absolute ceiling 17,000ft.

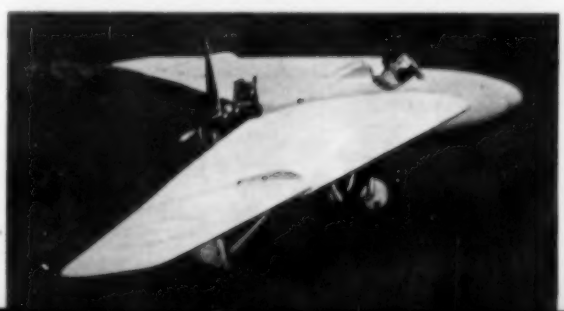
Pterodactyl Mk V Constructed in 1932, the Mk V was the last, largest and by far the most ambitious of the Pterodactyl family. A two-seater fighter, it was designed to mount an electrically operated tail turret (though this was never actually fitted), and there were two synchronized Vickers guns for the pilot. The engine was a Rolls-Royce Goshawk I, steam-cooled, and delivering some 650 h.p. at 15,000ft. In layout the machine was a sesquiplane, the top wing carrying the controllers and rudders, and the lower wing contributing a useful amount of lift but serving mainly to assist in the distribution of stresses set up in inverted flight. Both wings were of metal construction and the fuselage framework —of square-section steel and duralumin tubing—was covered with detachable metal panels. As on the Mk IV, the main undercarriage was of tandem twin-wheel type, and the lower wing carried trailing, outrigged wheels.

After some development flying the steam-condenser system was revised, fin surfaces were fitted beneath the upper wing, and a countersunk exhaust system was installed.

The Pterodactyl V carried the full two-seater-fighter load specified at the period, including two-way radio, and provision was made for bombs. Span was 46ft 8in, length 20ft 6in, wing area 396 sq ft, wing section R.A.F.34, weight empty 3,534 lb, weight loaded 5,100 lb, maximum speed 190 m.p.h. at 15,000ft, landing speed 66 m.p.h., rate of climb at 12,000ft 1,450 ft/min, service ceiling 30,000ft. In general, performance compared well with that of the contemporary Hawker Demon.

Pterodactyl Mk IV (D.H. Gipsy III).

Pterodactyl Mk Ia (Armstrong Siddeley Genet).



Pterodactyl Mk V (Rolls-Royce Goshawk I).

THE WESTLAND FAMILY . . .

ARMY CO-OPERATION

Lysander I and I (TT) Designed under the direction of Mr. W. E. W. Petter to Specification A.39/34, the Lysander had a personality all its own, not only in respect of handling and performance, but in appearance also. (During the war years many people recognized only Lysanders and aeroplanes.) For army co-operation work, as it was understood before 1939, it was essential that the pilot and observer should have the widest possible range of view in a forward and downward direction, and this consideration led to the adoption in the Lysander of the strut-braced high wing. Undercarriage retraction was originally proposed, using a stub wing, but the unorthodox cantilever arrangement finally adopted was lighter, and had no greater drag. The main member was shaped like an inverted U and was in the form of an aluminium-alloy extrusion of roughly rectangular section. Such a system allowed the two fixed Browning guns and landing lights to be disposed in the wheel fairings, which also served as the attachment for stub wings for the carrying of twelve anti-personnel bombs. The wing was of characteristic plan form and was fully slotted and flapped. Handley Page leading-edge slots extended over the entire span, the inner portions being lift slots while the outer portions were normal tip slots. The inner slot was connected by levers and linkages to the trailing-edge flaps. *Flight* reported:—

"By very careful design the arrangement has been so adjusted that by a suitable choice of take-off attitude the pilot can cause the lift flaps to come down the desired number of degrees. If he lifts the tail more during the take-off, the machine will run along without the slots opening or the flaps coming down, whereas if the tail is kept lower than desired the slots and flaps will open fully, and the drag will be greater than desirable, so that probably the take-off run will be increased. Similarly, on landing: by dropping the tail sufficiently the leading-edge slot automatically brings the flap down to its full extent, which results in the steepest approach and shortest landing run. It might have been thought that as the leading-edge slot is, so to speak, incidence-operated, it might be possible, in pulling the machine out of a steep dive, for example, to cause the slot and flap to open at high speed. This, however, has not been found to be the case, presumably because in a pull-out from a dive, the machine does not reach an angle of incidence sufficiently great to cause the slot to open."

In addition to the two fixed Browning guns the Lysander I had one or two gas-operated guns on a Fairey mounting in the rear cockpit. Provision was made for radio, a camera, parachute flares, oxygen and retractable message-hook below the starboard side of the fuselage. Span was 50ft, length 30ft 6in, weight empty 4,065 lb, and gross weight 5,920 lb. The Bristol Mercury XII engine gave a maximum speed of 229 m.p.h. at 10,000ft, minimum speed (engine on) of 55 m.p.h., and a sea level rate of climb of 1,650 ft/min. At an economical cruising speed of 150 m.p.h. still-air range was 500 miles. Service ceiling was about 26,000ft. With full load the Lysander I could clear a 50ft obstacle in 230 yards, the unstick run itself being only 165 yards.

The Lysander I (TT) was a target-tug conversion.

Lysander II and II (TT) This mark was almost identical to the Lysander I except that it had a Bristol Perseus XII sleeve-valve engine in place of the poppet-valve Mercury. Empty and gross weights were 4,160 lb and 6,015 lb, and top speed at 10,000ft 230 m.p.h. Take-off distance to 50ft was 245 yards. Lysander IIs were built under licence by the Steel Car Corporation of Canada, and the type was also used by Turkey and Egypt. The Lysander II (TT) was a target-tug conversion.

Lysander III (TT) A target-tug version of the Lysander with Mercury 20 or 30 engine and carrying an electrically driven, triple-drum winch. Stowage was provided for five sleeve targets.

Lysander IIIA (TT) A target tug with Bristol Mercury 30 engine.

Lysander (Agent-dropper) This version of the Lysander could be fitted with a 150-gallon tank beneath the fuselage and a long, fixed ladder to the rear cockpit, for the convenience of agents.

Lysander (Track-type Undercarriage) During 1938 a Dowty track-type undercarriage was installed on a Lysander, and with this in place the aircraft was taxied at speeds up to 70 m.p.h. Before take-off and landing tests could be made, however, the work was stopped.

Lysander (Castoring Wheels) Castoring wheels were also tried out on a Lysander.

Lysander (Ventral Gun Position) Known as The Cow, or sometimes by an even more descriptive appellation, a Lysander was adapted during 1940 to take a prominent ventral gun position, entailing an unpleasing distention of the lower fuselage.

Lysander (Dive Bomber) The wings of one experimental Lysander were fitted with braking surfaces, with a view to increasing the effectiveness of the aircraft as a dive bomber.

Lysander (Ground Attack) During 1940 a Lysander II was modified to take two 20 mm guns, attached to the undercarriage, for the attack of ground targets.

Lysander (Turret) An experimental installation of a Boulton Paul four-gun turret was made on one Lysander.

Lysander (Night Fighter) For intended employment as a patrol night fighter, one Lysander was fitted with "package" guns.

(Above) Lysander I (Mercury XII). (Below) Lysander Agent-dropper.

Lysander II (Bristol Perseus XII). (Below) Lysander II with Stieger wing.

The Greeks had no word for it

Great epics have been written—said the Managing Director—
about the glory that was Greece and so on and so forth but,
for myself, I regard the Ancient Greeks as rather Small Beer.
As every schoolboy knows, they sat outside the City of Troy
for ten solid years arguing and quarrelling before they thought up
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(Above) Lysander tandem-wing development. (Below) Paris Show model of Limousine (Rolls-Royce Falcon III).

THE WESTLAND FAMILY . . .

***Lysander* (Stieger Wing)** A Lysander II was modified by the Blackburn company to take a special Stieger high-lift single-spar wing, of constant chord, and slightly swept forward.

***Lysander* (Tandem-Wing Development)** During 1941 a Lysander was fitted with a modified fuselage, with a four-gun, power-operated turret in the rear, and with a wide-span tailplane, or secondary mainplane (as in the French Delanne formula), having twin fins and rudders at its extremities.

***Lysander II* (Air/sea Rescue)** A number of Lysander IIs were modified during 1943 to carry two Lindholme dinghy sets on the stub wings and smoke floats under the rear fuselage.

***Lysander II* (Glider Tug)** A number of Lysander IIs were modified for glider-towing duties.

CIVIL TRANSPORTS

Limousine Describing a visit to Yeovil a few days previously, *Flight* of August 7th, 1919, stated that "the large and well organized drawing office was busy with the designs for several post-war commercial machines, one of which is already in production, the first machine of the batch being in flying trim on the day of the visit." The account went on to say that the machine, which was known as the Limousine, had been designed to combine the qualities of "a luxurious motor and a yacht." It was a two-bay cabin biplane, powered with a Rolls-Royce Falcon III engine, and with the pilot occupying the rear port seat, which was raised above the floor of the cabin in order to bring his head above the roof. One passenger sat next to the pilot, on a lower level, and the other two were placed near the front wall of the cabin, the occupant of the port seat facing forward and the other sitting with his back to the wall. "The object of this placing was not clear at first," went on *Flight's* report, "but was explained when Mr. Norton took his seat in the machine, the other front seat being occupied by a shorthand-typist, who calmly placed her typewriter on a little hinged table attached to the front wall of the cabin. The writer of these notes was requested to take the remaining seat so as to be in a position to testify that a message was dictated by Mr. Norton during the trip, was first taken down in shorthand and then transcribed on the typewriter." After a lengthy account of preliminaries, the report goes on, "There we sat, as comfortable as if we had been at rest on the ground, and yet we were travelling along at over a hundred miles an hour. . . ."

Designed by Mr. Bruce, the Limousine measured 38ft 2in in span and was 28ft 6in long. Empty and gross weights were, respectively, 2,183 lb and 3,383 lb, range 290 miles, and landing speed 50 m.p.h. Cruising speed was 85 m.p.h. at 1,750 r.p.m. With full load the Limousine would climb initially at 1,000 ft/min, "which is sufficient," *Flight* remarked on the occasion of the machine being exhibited in Paris late in 1919, "for clearing obstacles around the aerodrome on taking off." A useful attribute!

The Paris Show version of 1919 had an oblong radiator, instead of the Bristol Fighter type, and a remodelled tail.

Limousine Mk II At the Olympia Aero Show of 1920 Westland exhibited the Limousine Mk II, fitted with a 300 h.p. Hispano-Suiza engine in place of the Falcon, and with petrol tanks suspended beneath the wings instead of being carried within the fuselage. By this means considerably greater stowage space was made available, and the fire risk in an accident was lessened. Structural strengthening allowed a load of three passengers plus 230 lb of goods to be carried, the corresponding wing loading being 8.7 lb/sq ft.

Six-seater Limousine For the Air Ministry Competitions for commercial aircraft, conducted at Martlesham Heath during the summer of 1920, Westland produced an enlarged development of the Limousine, powered with a 450 h.p. Napier Lion and with the number of seats (including the pilot) increased to six. Like its forerunners, the new machine was docile to fly, and on the delivery flight to Martlesham Capt. Keep is said to have left the controls and to have entered the cabin for a chat and a smoke. (As in the Mk II Limousine, the petrol tanks were out under the wings.) The contest was interesting and exciting. After a duel with the Sopwith Antelope, flown by Harry Hawker, the Six-seater Limousine emerged victorious to win the £7,500 first prize in the "Small-type Aeroplanes" class.

Several examples of the type were subsequently built. The original competition entry, registered G-EARV, was sold to Mr. Sidney Cotton (whose name will long be remembered in connection with the "Sidcot" suit), and was used for spotting seals in Newfoundland. Later, when participating in a gold rush, the same machine landed, under thrilling circumstances, on the thin ice at Stag Bay, Labrador.

The three-bay wings of the Six-seater Limousine measured 54ft in span, and the length was 33ft 6in. Empty and gross weights were, respectively, 3,823 lb and 5,850 lb, the maximum speed 118 m.p.h., and the landing speed a mere 46 m.p.h.

***Westland IV* (Cirrus III engines)** In the spring of 1929 a six-seater high-wing monoplane, with three Cirrus III engines of about 95 h.p. each, was being test-flown from Yeovil by F/L. Paget. Officially known as the Westland IV (though the description "limousine" died hard), it was of wooden construction. The rudder was that of a Wapiti, and though oleo legs were foreseen, the first machine—G-EBXK—was initially flown with "bungee"-type shock absorbers, thus being, perhaps, the last civil aeroplane of any size to incorporate this feature. Span was 57ft 6in, length 37ft 6in, empty weight 3,145 lb, and gross weight 4,900 lb.

***Westland IV* (Cirrus Hermes engines)** At the Olympia Aero Show in July 1929 Westland displayed an improved version of Westland IV, with metal rear-fuselage, registered G-AAGW, and powered with three Cirrus Hermes engines in place of the former Cirrus IIIs. Figures issued on that occasion were: Empty weight 3,150 lb, gross weight 5,500 lb, payload for 525 miles 1,240 lb, maximum speed at sea level 120 m.p.h., cruising speed 100 m.p.h. With one of the engines stopped the absolute ceiling was about 6,000ft.

Later in the year 1929 this same machine was modified, the fairing of the undercarriage was improved, mudguards were added above the wheels, and the fairing beneath the fuselage was removed to facilitate inspection and maintenance. Engine cowlings were also redesigned to lessen drag. For this version the following figures were quoted in December 1929: Empty weight 3,642 lb, gross weight 5,750 lb, maximum speed 110 m.p.h., cruising speed 95 m.p.h., range with two-thirds fuel, 350 miles. Two Westland IVs were built. Completely up-to-date (it was proudly remarked

(Above) Six-seater Limousine (Napier Lion). (Below) Westland IV prototype (three Cirrus III).

Wessex 8-seater (three 7-cylinder Genet Major).

Wessex for Sabena (three 5-cylinder Genet Major).

Woodpigeon Mk I (Bristol Cherub).

Widgeon Mk I (Blackburne Thrush).

THE WESTLAND FAMILY . . .

at the time) with wireless and wheel brakes, G-AAGW was acquired by Imperial Airways for charter work.

Wessex (5-cylinder Genet Major engines) The Wessex was a remodelled Westland IV, powered with Armstrong Siddeley five-cylinder Genet Major radial engines. Four were supplied to Sabena during 1930, and the following data apply to these machines: Empty weight 3,425 lb, gross weight, 5,750 lb, maximum speed 108 m.p.h., cruising speed 95 m.p.h., stalling speed 52 m.p.h., initial rate of climb 530 ft/min, duration (two-thirds fuel) 3½ hr, ceiling on two engines 4,000ft.

Wessex (7-cylinder Genet Major engines) During 1931 a version of the Wessex was produced with the then-new seven-cylinder Genet Major engines of about 140 h.p. each. This model was known as the High-Performance Type, the version with the earlier power plants being described as the Standard Type. The structure of the former was strengthened, and various improvements, including balanced ailerons and a new windscreen, were incorporated. The Westland IV supplied to Imperial Airways was converted into the High-Performance Type and two additional Wessexes were supplied. Figures for the High-Performance Wessex were: Empty weight 3,755 lb, gross weight 6,000 lb, cruising speed 100 m.p.h., two-engine ceiling 6,000ft.

Wessex Eight-seater This model was used, under the registration G-ABVB, by the Portsmouth, Southsea and Isle of Wight Aviation Co., Ltd., for the Portsmouth-I.o.W. ferry service, and was distinguished in having accommodation for eight passengers, a raised cockpit, revised vertical tail surfaces, and a strengthened undercarriage to provide for the greater all-up weight of 6,300 lb. Townend rings were fitted over the seven-cylinder Genet Major engines, and the cruising and maximum speeds were, respectively, 105 m.p.h. and 122 m.p.h.

In all, eight Wessexes, of various models, were built.

LIGHTPLANES

Woodpigeon Mk I For the Air Ministry's Light Aeroplane Competition at Lympne in 1924 Westlands produced a tiny two-seater called the Woodpigeon, which was a biplane counterpart of the monoplane Widgeon, later described. The wings could be folded round the rear spar joints and trailing-edge flaps were fitted over the whole span of both wings. These flaps served not only as camber-changing devices but as ailerons also, and Mr. Bruce had contrived that their movement should be automatic in normal flying, though when the pilot desired more camber than was automatically provided, he was able to over-ride the mechanism. The Woodpigeon proved less successful than the Widgeon, and is said to have been difficult to keep in the air, which is hardly surprising when it is noted that the engine was a Bristol Cherub of only 32 h.p. whereas the gross weight was 779 lb. The span was 22ft 9in, length 19ft 6in, maximum speed 72 m.p.h., landing speed 32 m.p.h.

Eventually the competition Woodpigeon, G-EBIY, was fitted with wings of longer span, as developed for the Mk II aircraft.

Woodpigeon Mk I (A.B.C. Scorpion) Woodpigeon G-EBIY was acquired by the Seven Aeroplane Club, fitted with an A.B.C. Scorpion Mk II, driving a Fairey-Reed airscrew, and entered for the Lympne Lightplane Meeting in September 1926.

Woodpigeon Mk II In this version of the Woodpigeon the wing span was increased to 27ft, the tailplane was made adjustable, and other refinements were incorporated. Empty and gross weights were 545 lb and 885 lb, and with a 45 h.p. Anzani engine performance proved satisfactory. For several years Woodpigeon Mk II G-EBJV was flown by W/C. Mitchell, a local owner who served with distinction in the R.A.F. as the oldest night-fighter pilot.

Widgeon Mk I This little parasol monoplane was proposed by Mr. Davenport and built for the Lympne trials of 1924, though it met with a mishap on its first circuit of the course. In September of that year *Flight* remarked that it was of very unorthodox design compared with the majority of the entries, not only as regards aerodynamic features but also in the matter of structure. "The view laterally, forward and aft and downwards," it was observed, "should be well-nigh perfect, while even in an upward direction the view is restricted to but a very small extent. This is due to the fact that the monoplane wing tapers considerably in chord towards the root, so that the pilot in the rear cockpit can look up and backward, while the front pilot can look in all directions, except diagonally up and back." The fuselage was almost identical with that of the Woodpigeon, being of girder construction and braced by piano wire. As on the Woodpigeon, full-span aileron/flap surfaces were fitted, and the wings were arranged to fold. The engine was a 1,096 c.c. Blackburne Thrush three-cylinder radial, the span 30ft 8in, length 20ft 5in, wing area 145 sq ft, weight empty 475 lb, gross weight 815 lb, maximum speed 72 m.p.h., and landing speed 32 m.p.h.

Widgeon Mk II When the Lympne trials of 1924 had proved that the tiny engines fitted to the competing aircraft were quite inadequate for the loads carried, the Widgeon was fitted with a

Widgeon Mk II (Armstrong Siddeley Genet).

The Goodyear Rotor Brake fitted to the Westland S-51 Dragonfly.

IT'S THE BRAKE THAT IS ALWAYS ON TOP

Judgement tempered by 40 years of knowledge ensures the standard of Westland achievements. Likewise, the long pioneering and world-wide experience of Goodyear always puts each of their products — such as the Goodyear Rotor Brake fitted to the Westland S-51 Dragonfly — at the top of its class.

Developed from the proved Goodyear Single Disc Brakes and after new, demanding tests, the Rotor Brake stops the rotor as soon as the plane lands, allowing ground personnel to approach quickly and safely. It is also a reliable parking brake, yet does not drag on the rotor during flight.

A vital part of the brake unit, which is very easy to service, is the Goodyear ½" Vertical Master Cylinder, exclusively constructed for aircraft use. Made of light-weight alloy, the cylinder efficiently controls the hydraulic braking system—building up, varying and releasing the brake pressure. And an integral reservoir constantly maintains the correct volume of hydraulic fluid—automatically compensating for expansion, contraction and seepage loss.

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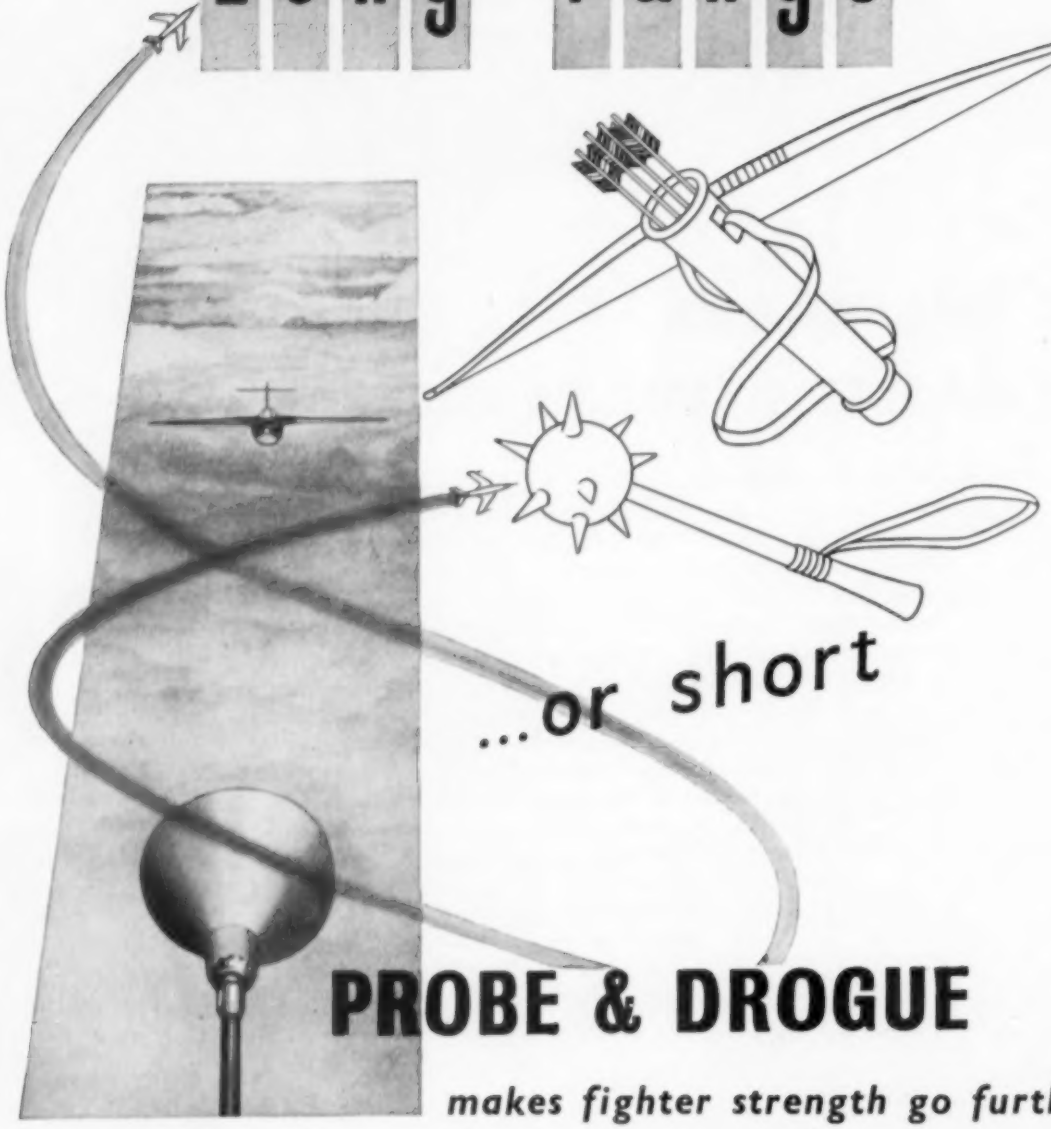

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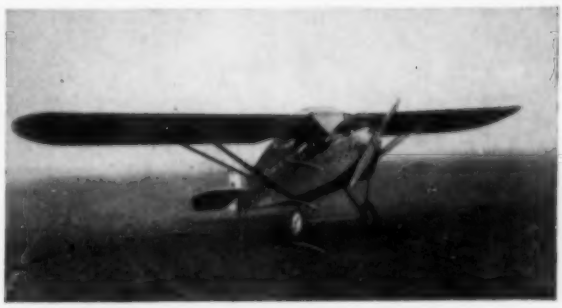
Widgeon Mk III (Cirrus III).



Widgeon Mk III (cabin conversion) (Cirrus III).

THE WESTLAND FAMILY . . .

five-cylinder Armstrong Siddeley Genet of 70 h.p., and in this form was known as the Widgeon Mk II. Flown by its owner, Dr. Whitehead-Reid, it was familiar at flying meetings of the 1920s.

Widgeon Mk III Late in 1926 it was decided, in the light of experience with the Widgeon Mk II, to redesign the type for quantity production. The wing was made of constant chord and thickness, the fuselage lines were completely revised, the cockpits moved aft (so that the forward seat was completely under the wing), and an oleo undercarriage was fitted. Originally the engine was an 80 h.p. A.D.C. Cirrus II, but later machines, to suit specific requirements of private owners, were powered with the Armstrong Siddeley Genet, D.H. Gipsy, or Cirrus Hermes. Span was 36ft 4½in, length 23ft 5½in, wing area 200 sq ft, and with the Cirrus II engine the empty and gross weights were 852 lb and 1,400 lb. Top speed was 100 m.p.h. and landing speed 42 m.p.h.

Widgeon Mk IIIA This designation applied to the Widgeon III with a split-axle wide-track undercarriage in place of the original narrow-track cross-axle type.

Widgeon Mk III (Seaplane) Two Widgeon IIIs, with Cirrus III engines, were mounted on a Saunders twin-float undercarriage.

Widgeon Mk III (Cabin Conversion) One Widgeon III was fitted with a coupé top.

Widgeon Mk III (Metal Fuselage) Widgeon G-AAGH had a fuselage of square-section duralumin tubes, similar in construction to that of the Wapiti.

Widgeon (A.B.C. Hornet) A Widgeon was flown with an A.B.C. Hornet flat-four engine of some 80 maximum horse power.

AUTOGIROS

C.29 The C.29, which was built during 1934, was a very advanced Autogiro indeed. Designed by Westlands in conjunction with Senor Juan de la Cierva, of the Cierva Autogiro Co., it was a five-seater, powered with an Armstrong Siddeley Panther engine driving a two-blade Fairey-Reed metal airscrew. The rotor and the rotor mechanism (the latter being of the direct-control type, wherein the rotor hub could be moved and the plane of the rotors varied relative to the fuselage) were constructed by the Cierva company, while the airframe was entirely Westland-built. Of square-section steel and duralumin tubing, the fuselage was of good aerodynamic form and carried a deep-chord fin-and-rudder assembly. The tailplane had oblique fins at its extremities and the port half had an inverted aerofoil section to offset airscrew torque effect. Tests disclosed formidable ground resonance, thought to be rotor vibration, and development was shelved until further experience could be obtained from smaller experimental autogiros. Although taxied, the aircraft was never flown, and was finally abandoned on the death of Senor de la Cierva. Rotor diameter was 50ft, fuselage length 38ft, weight empty 3,221 lb, gross weight 5,000 lb, estimated maximum speed 160 m.p.h., and landing speed 21 m.p.h.

C.L.20 In the designation of this aircraft the "C" denoted Cierva and the "L" Lepère—M. George Lepère being chief engineer of Lioré et Olivier, French licensees of the Cierva company. An attractive side-by-side two-seater, the C.L.20 had a Pobjoy Niagara S seven-cylinder radial engine of 90 h.p., and its wide-track faired undercarriage was carried on outriggers. The fuselage was of welded-steel tubing, and the cabin was liberally provided with transparent panelling. The three blades of the direct-control rotor could be folded for parking. Successful test flights were made by R. A. C. Brie, but the war intervened before production could be started. Rotor diameter was 32ft, length 20ft 3in, weight empty 840 lb, gross weight 1,400 lb, maximum speed 106 m.p.h. and landing speed 25 m.p.h.

HELICOPTERS

S-51, Series A As built at Yeovil, the majority of Westland S-51s have been powered with the Alvis Leonides engine, denoted by "Series A" in the designation. The centre portion of the S-51 fuselage is of welded steel tubes; it carries the main wheels and rotor-head structure, and houses the engine and tanks, together with auxiliaries such as the electrical generator, radio and batteries. The Alvis Leonides 521/1 is mounted horizontally in the fuselage centre-section and drives the main rotor (originally having composite blades, but now all-metal) through a vertical shaft and double epicyclic reduction gearing. The cabin seats four, with the pilot in front and the three passengers abreast at the rear. Flying controls consist of a collective-pitch lever, on the port side of the pilot's seat, and a central control column. Jointly these control the pitch of the main rotor blades by means of mechanical linkages to selector valves on servo-operated hydraulic jacks. (On the earliest machines of the type the control was of the direct manual type.) Foot pedals operate the pitch change of the tail rotor blades, and on the collective-pitch lever is a twist-grip, acting as an engine-throttle fine adjustment, which can be operated

C.L.20 Autogiro (Pobjoy Niagara S).

(Above) C.29 Autogiro (Armstrong Siddeley Panther). (Below) S-51 Series A (Alvis Leonides 521/1).

S-51, Series A, with pontoons (Alvis Leonides 521/1).

Dragonfly HC.2 (Alvis Leonides 50).

THE WESTLAND FAMILY . . .

independently of the synchronizing linkage of throttle and pitch lever. Rotor diameter is 49ft (originally 48ft), length (rotor folded) 42ft 11in, all-up weight 5,700 lb, maximum speed 103 m.p.h., maximum weak-mixture cruising speed 86 m.p.h., maximum still-air range (83 gallons of fuel) 308 miles, service ceiling 13,000ft, hovering ceiling (without ground cushion) 6,000ft.

S-51, Series B This is the S-51 with Pratt and Whitney Wasp Junior engine in place of the Alvis Leonides.

Dragonfly HAR.1 A version of the S-51 for the Royal Navy, characterized by composite main-rotor blades. The engine is a Leonides Mk 50, and the machine is equipped for air/sea-rescue and special photographic duties.

Dragonfly HAR.3 Like the HAR.1, this is a Naval helicopter but has all-metal main rotor blades and hydraulic servo-control mechanism.

Dragonfly HC.2 Equipped as a casualty-evacuation aircraft for the R.A.F., this variant is powered with an Alvis Leonides 50 engine and can carry two stretcher cases in enclosed panniers on each side of the fuselage. Alternatively, casualties can be seated in the cabin.

Dragonfly HC.4 An R.A.F. version with Alvis Leonides 50 engine, all-metal main rotor blades, and hydraulic servo-control mechanism.

Dragonfly (Special Developments) On behalf of the Ministry of Supply, a number of Dragonflies have been adapted for special tests and duties, the nature of which may not at present be specified.

S-55 The civil Westland S-55 has a Pratt and Whitney Wasp R-1340-40 engine of some 600 h.p. That efficient use is made of this power is proved by the fact that the S-55 has three times the load-carrying capacity of the S-51, though its overall dimensions are very little larger. In the construction of the semi-monocoque fuselage magnesium alloys are largely used. The engine and its accessories are mounted in the nose, rather than on the centre of gravity as in the S-51, and access is gained through two non-structural nose doors which fold back on vertical hinges. The dual-control cockpit is located high up above, and slightly behind, the engine. Arrangement of the main cabin around the centre of gravity and at a low level allows variations in loading without affecting the balance of the machine. Each of the four undercarriage wheels has individual hydraulic shock-absorption; the two nosewheels are fully castering and self-centring, and a skid protects the tail rotor in case of tail-down landings. The pair of S-55s acquired by B.E.A. for their regular passenger service between the South Bank and London Airport are being supplied with twin pontoons as a safeguard in the event of a forced alighting on the river. The rear ends of the pontoons are undercut to permit tail-down landings. Another recent development is the fitting on an S-55 of a Vokes silencer, weighing about 60 lb in its experimental form and effecting a considerable reduction in noise level.

S-55 data: Main rotor diameter 53ft, length of fuselage 41ft 8½in. weight empty 4,912 lb, weight loaded 7,200 lb, maximum speed at sea level 112 m.p.h., cruising speed 86 m.p.h., hovering ceiling (without ground effect) 3,200ft, still-air range 300 miles.

Whirlwind HAR.1 This is a version of the S-55 for the Royal Navy, powered with a Pratt and Whitney R-1340-40 engine, having an empty weight of 5,286 lb, a gross weight of 7,500 lb, a maximum speed of 110 m.p.h., and a range of 290 miles.

Whirlwind HAR.2 A similar machine to the HAR.1, but built for the R.A.F. and at present scheduled to operate for Coastal and Transport Commands.

Whirlwind HAR.3 A development for the Royal Navy, having the Wright Cyclone R-1300-3 engine.

Whirlwind HAR.4 Powered with a Pratt and Whitney R-1340-57 engine (with a 12:1 blower ratio, whereas the R-1340-40 has a 10:1 ratio), the HAR.4 model is built for the R.A.F. and is operating in the Far East.

Whirlwind 5 This version, with Alvis Leonides Major engine, is at present scheduled for the Royal Navy.

Whirlwind (Special Developments) On behalf of the Ministry of Supply, a number of Whirlwinds have been adapted for special tests and duties, the nature of which may not at present be specified. It is known that in America helicopters of this class have been employed not only on general transport and search-and-rescue duties, but as "assault" transports (occasionally carrying such weapons as mortars), for anti-submarine work, and on mine-sweeping duties.

S-55 (Pratt and Whitney Wasp R-1340-40).

Whirlwind HAR.1 (Pratt and Whitney Wasp R-1340-40).

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Flight, 15 April 1955

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PART III

RECOLLECTIONS OF MACHINES AND MEN

By HARALD PENROSE, O.B.E., F.R.Ae.S., A.M.I.N.A.

"Flight" photograph

In the cockpit of the Pterodactyl V is Harald Penrose, author of these reminiscences. Sir Ernest Petter is in the gunner's position. Standing are Capt. G. T. R. Hill (Pterodactyl designer), Mr. Mettam (in charge of stress department) and Capt. Keep (general manager).

WHEN I first came to Westland a group of buildings labelled PETTER OIL ENGINE MANUFACTORY had been set between the railway and a small grass aerodrome which even then was inconveniently narrow for so heavily laden an aeroplane as the D.H.9a that was the mainstay of the Company. Dominating all was a girder-topped shed, then the biggest single-span hangar in the country, and known as the Vimy shop from its recent war-time purpose.

Thirty years later the aerodrome is twice as long, but even narrower, for a large erecting shop encroaches on its southern edge, dominating the Vimy shop, beyond which are more buildings grown from flight sheds and experimental shop to the dignity of laboratory and offices of Normalair. Where wooden fuselages and wings once were built is now a store; and where Petter engines were made and tested are fitting shops, tinsmiths, press tools; and many other buildings have been added in the course of time.

Except for the first two designs I have seen all Westland aeroplanes and flown in or piloted most of them. I think it was the initial R.A.F. Display after the first World War that introduced to me the first of these—a khaki-painted Weasel. Certainly at about that time I saw it being flown at Farnborough, and there also found that strange angular creation of the Air Ministry's imagining—the Walrus. However, it was the grey-painted Limousine that began my closer familiarity with Westland aircraft in the air, this through an initial flight from Yeovil to Bristol, piloted by Maj. Lawrence Openshaw, M.A., who had just succeeded Capt. Stuart Keep, M.C., B.Sc., as chief test pilot—the latter having crashed a year before in that very advanced conception the Dreadnought. At that time much of the wreckage was still in one of the hangars, including the passenger cabin built into the thick wing root. One of the wings had just been statically tested as a retrospective check on the many novel problems of stressing that had arisen with the complex steel multi-spar structure.

Robert Bruce, O.B.E., M.Sc., an elderly and inspiring engineer whose experience dated from the early days of the Bristol Company with Coanda, was managing director and had been so since the inception of the Petter Aviation Department in 1915. He fired people with enthusiasm and exacted utmost effort. Not only did he run the business side but, with his deep knowledge of aerodynamics and structures, he could not be kept from the drawing office, where Arthur Davenport, F.R.Ae.S., protagonist of monoplanes, reigned as chief designer. By the time I joined the company, Keep had been appointed works superintendent and was stamping manfully around with the aid of a stick and Desoutter artificial legs, and another ex-Westland pilot, Bill Gibson, A.F.R.Ae.S., was works foreman. A recently joined member of the company was Geoffrey Hill, M.C., M.A.—and it was, in fact, as a member of his staff on the design of that early tailless aircraft, the Pterodactyl, that I was initially engaged.

During the previous year's attachment as a university student I had been lucky enough to have an initiation to test flying by acting as observer in the trials of the Yeovil bomber, and crouched in its large draughty rear cockpit saw for the first time the beautiful landscape of South West England from great heights on a summer's day. Now came opportunity to fly in the Westbury, and the small biplane and monoplane which made for comparative trials at the Lympne light aeroplane competition. The later version of the Widgeon gave me many pleasant excursions around England, as well as providing the first lesson that aeroplanes can break most unexpectedly—one day both wing-folding hinges failed, and a modern-looking sweep-back was only arrested by the rear spar butts riding onto the centre section.

One of the most interesting designs in that period was the Wizard, a private venture initiated by Davenport as the result of the success of his Widgeon Lympne monoplane. Originally powered with the 275 h.p. Rolls salved from the crashed Limousine, its ultimate derivation, with the new Falcon engine, was an attractive all-metal parasol that marked a big advance on the biplane fighters that were its contemporaries. Although easily the swiftest climber of its day, it nevertheless suffered from the prejudice against monoplanes before the first World War, and most pilots flying it for the first time found so well streamlined a monoplane somewhat strange after the comfortable boxed-in feeling of a wire-whistling biplane. Indeed, the course of aeronautical development in those days was often slowed by the conservative ideas of the R.A.F. and Air Ministry, against which the technical staff of manufacturers had to battle.

Certainly Westland were early leaders of monoplane thought, for their subsequent conception of the Interception Fighter, whose design was initiated in late 1928, foreshadowed closely the Hurricanes and Spitfires of a decade later. The Interception Fighter was a delightfully buoyant machine to fly, but in its original form displayed a mysterious inability to loop without a series of inadvertent rolls off the top—a problem later solved, by the then novel hot-wire method in the wind tunnel, as a breakdown of flow due to root interference. However, the saving grace of those earlier days was that the simpler structures made basic modifications easy, and the fault was quickly cured. Although the machine did not go into production an advanced design derived from it was the C.O.W. gun fighter. Here the problem of installing a large, slow-firing gun for the first time in a single-seater fell to a colleague and me, for by that time I had changed from design duties to works manager of the civil aircraft department, with interesting odds and ends (such as this) and a little demonstration flying thrown in.

To our great loss, Openshaw was fatally injured in a collision while racing a Widgeon; but in that great character Louis Paget, D.F.C., who even in a crash could not be separated from his eyeglass, Westland found another fine chief test pilot—a man to whom I owe everything for his encouragement in letting me fly types that I had never dreamed would be within my scope. When ultimately he also met with an accident in a Widgeon, and retired from flying, I had by that time been lucky to obtain fair experience of flight testing which, coupled with vague academic qualifications, secured me the gratification of an appointment as chief test pilot.

Already the Wapiti was being built in great numbers; in fact, at one time the R.A.F. had more of these machines than any other type. In addition to the testing of numerous variants, a great deal of experimental development work was carried out, including the first Dunlop wheel brake system; methods of cockpit heating; early experiments in blind flying, using a Schilovski-Cooke turn indicator; metal propellers instead of wood; and trials of the first British compression-ignition engine, made by Bristol, as well as of their direct injection engine. Among many incidents is an occasion vividly impressed on my mind when we experimented with varying longitudinal inertias, and finally with a heavy metal propeller and extended weights aft in the fuselage; all this got rather too near to the borders of safety, and I found that a spin needed 17 turns for recovery, stopping only when I stood up to get out.

The intense cold of those open-cockpit machines with their laced fabric sides and draughty cowlings was such that at height hands, feet and limbs grew numb, and it was excruciating when they thawed. On the test climb with the Everest-Wallace the ceiling air was −62 deg. C, and the failure of the engine at that point came almost as a relief. After one of the longest glides on record a dead-engine landing was successfully made at Hamble.

Most aeroplanes have had their difficult moments. Service pilots at test establishments or squadrons, oblivious that production must not be too greatly disturbed, sometimes (correctly, nevertheless) criticize an aeroplane for residual defects. One wonders what they would have thought of the machine in its original condition. All test pilots could tell of fantastic moments when control or stability behave in a manner quite unlike anything which anyone has been trained to regard as conventional! As an instance, I remember my first take-off in a tailless machine, when it leapt into the air from the impact of its bicycle-type undercarriage against a hard molehill; and because the longitudinal damping was negligible the machine proceeded through the air

A technical discussion of Lysander features in the 1930s: (l. to r.) J. Johnson, W. Widgery, A. Davenport and J. Wingfield Digby.

RECOLLECTIONS OF MACHINES AND MEN . . .

in a series of fantastic phugoid oscillations, which every movement of the wing-tip controls seemed to make worse. Only on the next flight did one discover the right solution was to pull back the stick and wait in hope.

Similarly, with the last Pterodactyl, which although amazingly successful in many ways, was nevertheless dogged with misfortune. Its wing structure somewhat disconcertingly collapsed on the initial taxying trials, owing to an insignificant error in appreciating the eccentric loading of a secondary strut; and a year later its engine seized a few feet above Yeovil through a coolant failure just after taking off for the delivery flight to Farnborough. As the Air Ministry decided not to replace its experimental engine it faded from its page of history, unflown by anyone but me.

However, though engines stop, controls fail or structures break, one expects such things; and as long as none is too catastrophic the R.A.F. testing establishment is eventually handed an aeroplane which is reasonably docile and shows little trace of the vicissitudes of its development. At long intervals things may go a little too far during the makers' tests—such as the occasion of a wing failure on the P.7 torpedo monoplane I was diving, when only after landing by parachute did we receive at Martlesham an official telegram telling us not to dive as it seemed possible that the airworthiness requirements did not meet the case of the particular load carried. Most test pilots inadvertently become check-stressers for the stress office.

At times it can be a little exasperating. Our shaft-driven fighter was one of those self-landing aeroplanes which are such a delight to fly, and gave a superlative view. Looking astern to see that all the aeroplane was there after its first slow roll I found the fuselage enveloped in flames, and landed with all the fabric burned away. The D.O. put it right. I did another roll. There were the twenty-foot flames again, and the fuselage and part of the tail was once more soon without fabric.

On the retirement of Mr. Bruce in 1935 his assistant Teddy Petter, B.A., son of the chairman of the company, was appointed technical director. Captain Acland, of Vickers fame, became managing director. Geoffrey Hill had by this time accepted a professorship at London University, and although the Pterodactyl type was dropped (the significance of the swept wing not having been appreciated) Petter displayed further ingenuity in breaking from conventional practice in the various designs forthwith initiated, of which the army co-operation Lysander, based on Davenport's high-wing series, was the first. The general success of the machine, with its spectacular landing and take-off run, and the novel use of extrusions in its structure, revealed the inherent promise of Petter's talent.

The Lysander had the usual course of development. Those who flew production machines will understand what it was like to fly with a fixed tailplane and an elevator which originally gave instability in dives. There was even an occasion when the slats and leading edge alone were proved capable of sustaining the aircraft, for when the less extensively tested second prototype was dived at Martlesham it lost all its wing fabric, yet was safely landed by F/L. Collins of the A. & A.E.E. I also remember seeking to prove to Mr. M. B. Morgan—now Deputy Director (A) of the R.A.E.—that its landing run was even shorter than had been officially measured, and gave it, with the aid of some badly set slats, the heaviest landing of any aeroplane I have ever flown. However, it well demonstrated the strength of the structure, which, although considerably strained, held together sufficiently for the machine to be taxied with dignity to its hangar. Perhaps the full-span slats required a rather marginal technique for really effective use of this ubiquitous machine and thus at times secured the denigration of pilots unused to it; but when, with Britain beleaguered, the original function of army co-operation work became impossible, these sturdy aeroplanes under the command of A. Cdre. Sir Edward Fielden gave yeoman service on espionage work, landing and picking up passengers at night far into enemy-occupied territory.

The war eventually saw Westland fully engaged with the production and repair of Spitfires and Seafires. In the early stages we were still building Lysanders and the Whirlwind twin-engined fighter. The latter—locally known as "Crikey," from the Shell advertisement of that time—was faster at low altitudes than any contemporary fighter. Though I gather from a well-known pilot's book that he did the critical tests on this machine, my log records the initial flight of each prototype and many hundred other flights, including the first spins, first climbs to ceiling, all dives to maximum speed, as well as the first single-engine forced landing, and even the burning through of rear span and aileron control.

I have particular cause to be grateful for the Whirlwind's aggressive appearance, for, bursting through overcast in the early days of the war, I found myself heading straight for a machine with black crosses. Both of us, evidently mutually impressed, half rolled smartly into the cloud in opposite directions. A somewhat similar incident occurred towards the end of the war, when, flying a captured Messerschmitt with no radio, I suddenly felt my hair prickling and glanced round to find a Spitfire flying with a lethal look just behind my tail.

In those days scores of stratospheric flights made with the big single-seater Welkin, usually in clear weather because of recognition and radio difficulties, revealed tremendous views across war-time England, and on one occasion across the Channel to the as yet uninvaded beaches of the Cherbourg Peninsula. One remembers also a series of experimental climbs carrying a large tank from which liquid oxygen was injected into the engines to enhance performance at height. Nevertheless, such flying was insignificant compared with war-time production testing, when, under the managing directorship of doughty John Fearn, M.I.Mech.E., a great job was done by E. C. Wheeldon, M.I.P.E. (now managing director) and his works staff and men in keeping the pilots well supplied with over 2,000 Spitfire variants, as well as the production of Barracudas and Westland machines. Various pilots under "Hoggy" Hill helped out the flying, but James Ramsden of the unforgettable laugh must be mentioned, for he assisted with experimental work as well.

Towards the end of the war we all became interested in helicopters as the logical outcome of the Autogiros built by Westland in the pre-Munich era. It must have been in 1944 that Arthur Davenport and I flew with "Socks" Hosegood in a Sikorsky R.4 at Beaulieu, and there met O. E. Fitzwilliams, B.A., who joined the company as helicopter engineer when Westland acquired the licence to build the S-51. Though my experience with helicopters has been far less than with aeroplanes, my interest ranges back to the earliest Cierva Autogiro, and ten years later, in 1934, I added the C.30 to my licence as a preliminary to flying the Westland-built rotorplanes. The helicopter technique is much the same, and once it is familiar less judgment is required for landing and take-off than with fixed-wing machines, for it is inherently far safer. However, the maestros of the art are master-pilots, and among the earliest of these one must acknowledge Alan Bristow and the late Pete Garner, who quickly made their mark with the Westland S-51s in public demonstration.

The Wyvern, whose design had been initiated by Teddy Petter, was concurrently flying. Arthur Davenport had been appointed technical director, with John Digby, M.A., as chief designer, but the Wyvern proved to be the first of the more complex modern fighters to reveal how much time was required to secure proper development aerodynamically and mechanically. Unexpected problems arose with the turbine propeller combination, and the projected method of starting failed to materialize, while items such as reversing airscrews were scrapped as too great a problem, in favour of air brakes which had to be designed into the finished machine. It all took a long time to work out, and I undoubtedly had more forced landings with this machine than with any other type in the entire existence of the company; nor were we free from tragedy, for both an R.A.F. test pilot and two of my colleagues lost their lives in Wyverns, thus ending a sequence of 20 years' freedom from fatality. Nevertheless, the type basically was always pleasant to fly, and immediately proved popular when ultimately it was released to squadrons.

So one looks back through the vista of 30 of the 40 years since Westland was founded, and finds much the same scene, but with many changing characters. Throughout it has been a long sequence of endeavour to devise new and better means of making the most efficient possible aircraft in the light of the latest knowledge and deduction. The steps from those first exciting canvas-covered wooden structures through various forms of biplanes and monoplanes to the present masterpieces of aeronautical engineering can be seen as logical evolution in the industry as a whole. More has been attained than many dreamed. And so it steadily goes on. There are new conceptions, a new generation in the shops, a different staff, other designers and pilots—but the significant endeavour remains unchanged.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Air Marshal Sir Harold Lydford, A.O.C.-in-C., Home Command (on right) and A. Cdre. M. H. Dwyer, A.O.C. No. 62 Group (left) recently visited Bristol Aircraft at Filton. They were flown there in a Sycamore piloted by Mr. C. T. D. Hosegood (left centre) and are seen after being met by Mr. W. R. Farnes, aircraft division sales manager.

Promotion to Air Chief Marshal

THE promotion is announced of Air Marshal Sir Donald Hardman to the rank of air chief marshal. Since May 1954 he has been Air Member for Supply and Organization, and before that he was C.A.S. of the R.A.A.F. from January 1952. Immediately before that he was A.O.C-in-C., Home Command.

Sir Donald was born in 1899 and was awarded a D.F.C. while flying with the R.F.C. and R.A.F. during World War I. After the war he went up to Hertford College, Oxford, and then rejoined the R.A.F. with a short-service commission in 1921. He was granted a permanent commission four years later.

Cranwell Passing-out

THE 64th Entry of General Duties Branch flight cadets who passed out from the Royal Air Force College, Cranwell, on April 5th, 1955, were placed in the following order of merit:—

1, U/Off. J. F. Merry; 2, S. U/Off. F. M. A. Hines; 3, S. U/Off. J. N. Sawyer; 4, S. F/Cdt. A. D. Meeks; 5, U/Off. R. Horsfield; 6, U/Off. A. Salter; 7, S. U/Off. D. N. Cousins; 8, U/Off. D. C. Whitman; 9, U/Off. J. Bredenkamp; 10, S. F/Cdt. C. A. Herbert; 11, U/Off. P. M. Papworth; 12, S. F/Cdt. J. C. Holdway; 13, S. F/Cdt. A. W. Skinner; 14, S. F/Cdt. M. G. Thomas; 15, S. F/Cdt. P. D. Penfold; 16, U/Off. L. R. Morgan; 17, S. F/Cdt. J. S. Cresswell; 18, S. F/Cdt. S. M. V. Situnayake; 19, U/Off. M. A. Noble; 20, S. F/Cdt. R. A. Jackson; 21, S. F/Cdt. F. S. Masterson; 22, S. F/Cdt. A. P. Hilton; 23, S. F/Cdt. K. McDonald; 24, S. F/Cdt. A. L. Willings; 25, S. F/Cdt. N. G. Lea; 26, S. F/Cdt. R. L. Barcilon; 27, S. F/Cdt. C. G. Richardson.

Equipment Branch: 1, S. F/Cdt. D. A. McArthur; 2, S. F/Cdt. G. H. Hopkins; 3, S. F/Cdt. M. A. K. Ayub.

R.N.Z.A.F. Sqn. Leaves Cyprus

ON April 7th No. 14 Squadron, R.N.Z.A.F., began its move from Cyprus to Singapore, in accordance with the decision to concentrate New Zealand and Australian contributions to defence in the Far Eastern area.

The squadron has been in Cyprus for nearly two-and-a-half years, flying R.A.F.-supplied Vampire 9s. The aircraft have been left in Cyprus and Venom fighter bombers are being taken over in Singapore. Some families and squadron personnel are travelling by ship, while the remainder are being flown by Hastings of No. 40 Sqn, R.N.Z.A.F.

Sir Robert Armitage, the Governor of the Island, reviewed the squadron at a farewell ceremony which was also attended by Air Marshal Sir Claude Pelly, C-in-C. M.E.A.F., A. Cdre. C. D. C. Boyce, A.O.C. Cyprus, and senior officers of H.Q., M.E.A.F.

During the war No. 14 Squadron flew Kittyhawks and Corsairs in the South Pacific and afterwards formed part of the air forces of occupation in Japan. During its attachment to M.E.A.F. it has gained a fine reputation, not only during visits to most of the stations in the area, but also for its prowess in sports; throughout the unit's stay, its rugby team remained unbeaten. While in Cyprus No. 14 was commanded by S/L. S. M. Hope and S/L. N. H. Bright.

Kenya Awards

THE following is a continuation of the list of awards made to members of the R.A.F. for service in Kenya, the first part of which appeared last week.

D.F.C.

F/L. F. A. Train. Since joining No. 1340 (Harvard) Flight in Kenya in June 1953 for operations against the Mau Mau, F/L. Train has flown 404 sorties against terrorists, involving 410 hours' flying. At the altitudes at which the Harvards operate in Kenya there is little room for error by pilots, the terrain being extremely difficult and the weather unpredictable. From August to October 1954, he served as flight commander and with his commanding officer shared the responsibility of organizing and controlling the Flight's operations.

A.F.C.

F/O. S. Brisk. From March 30th, 1953, until February 1954, F/O. Brisk served with No. 1340 (Harvard) Flight on operations against the Mau Mau, completing 105 strikes. Later he joined the East African Communications Flight at Eastleigh, in charge of Auster "aky-shouting" operations (broadcasting from aircraft to terrorists on the ground below). Up to October last year he had completed 83 sorties on this work. In addition he has flown 370 hours on various types of communications aircraft, and his total flying time in the R.A.F. amounts to 3,750 hours on 25 types.

B.E.M.

F/Sgt. D. D. Clack. F/Sgt. Clack joined No. 1340 (Harvard) Flight at Mweiga, Kenya, in September 1953, being responsible for all aircraft armament, the bomb dump and the station armoury. Under him, no aircraft has ever been held up by any armament deficiency and up to October 1954 No. 1340 Flight had fired 1,237,300 rounds and dropped 28,200 bombs on anti-Mau Mau operations, often exceeding 50 sorties daily with only six aircraft in constant use.

Sgt. W. S. Williams. Senior armament N.C.O. of No. 214 Squadron, Sgt. Williams has been mainly responsible for the fact that his squadron has been able to maintain the high intensity of bombing required of it on anti-Mau Mau operations.

Sgt. R. Cowling. N.C.O. in charge of Harvard 2nd line servicing at R.A.F. Eastleigh since No. 1340 (Harvard) Flight was formed in 1953, Sgt. Cowling's initiative and drive have been mainly responsible for the high standard of servicing and turn-round of aircraft from second-line servicing, which has helped the Flight achieve its exacting flying target.

Sgt. G. D. Watson. N.C.O. in charge of R.A.F. Eastleigh's instrument section for 2½ years, Sgt. Watson has been responsible for all second-line instrument servicing of the operational aircraft at the station. When troops were being flown into Kenya early in the Mau Mau emergency he worked very long hours servicing navigational instruments, and contributed in some measure to the success of the airlifts of that time.

Mentioned in Despatches

F/O.s D. J. Hill and M. R. Holmes; Sgt. F. A. Brown; Cpl. M. V. Davis; Sen. A/C.s R. H. V. Ashley, H. C. R. Hill and M. Thomas; L. A/C.s K. E. Eagleton, P. N. Fallows and W. Henricks.

R.A.F. Champions

BY drawing (six all) with the Army at Twickenham on March 26th—on the run of the play they should have led by a small margin—the R.A.F. won the season's inter-Services rugby football championship. In previous matches the Navy had defeated the Army and the R.A.F. the Navy.

The Army led 6-0 well into the second half with a try by L/Bdr. S. A. Lowdon and a penalty goal kicked by Capt. A. B. Edwards. The R.A.F. had much the best of the closing stages of the game and scored a classic along-the-line try, with S.A/C. R. Blair, on the wing, the man to go over. F/O. M. R. Channer kicked a good penalty goal, in gusty conditions, a few minutes later.

If individual credits are to be given to the airmen, they should perhaps go to forwards F/O.s Collingridge, Bleasdale and Collard, to F/L. Paterson at full-back, and to the unusual football sense of F/O. Channer at stand-off.

Reunions

IT has been suggested that a reunion cocktail party and dinner for past and present aircrew and officers of No. 613 (City of Manchester) Squadron, R.Aux.A.F., be held in Manchester next October. Those interested in such a function are asked to contact F/L. L. A. Prickett, R.A.F., Ringway, Manchester.

R.N. Seaplane Bases, Port Said and Alexandria, and No. 269 Squadron will hold their 33rd annual reunion at Stewarts Restaurant, Old Bond Street, London, W.1, on April 30th. Particulars from Mr. W. C. Shilling, Kewferry Drive, Northwood, Middlesex.

CIVIL AVIATION

Slipper-tanked for additional range, T.A.A.'s sixth Viscount is seen on test before leaving for Melbourne on April 3rd. Thus equipped, two of the Australian Viscounts will be used to replace DC-4s on the Melbourne-Adelaide-Perth route, carrying 34 passengers in sleeper chairs.

K.L.M. CHOOSE THE DC-7C

TEN Douglas DC-7C Seven Seas have been ordered by K.L.M., national airline of the Netherlands, for delivery in the spring of 1957. The contract for these aircraft, which are intended mainly for non-stop operation between Amsterdam and New York, is valued at over £10m, including spares. Announcing the order, the Douglas Aircraft Co., recall that K.L.M. have purchased and operated every type of commercial aircraft produced by Douglas since the introduction of the DC-2 in 1934. Seven airlines, including six transatlantic carriers, have now ordered a total of 48 Seven Seas.

QANTAS TO WITHDRAW R/Os

AS facilities for pilot-to-ground R/T communications are set up along their routes, Qantas Empire Airways will dispense with radio officers. The airline has announced that, as a first step towards implementation of this policy, radio officers were withdrawn from crews operating the Pacific routes early in March. Displaced radio officers will be offered other appointments in the airline; seven of the men formerly employed as radio operators on the Pacific routes have, in fact, already been remustered in other positions—two as pilots, two as navigators, two as operations officers and one as a ground radio officer.

Voice communication by R/T rather than W/T has been standard practice on Q.E.A.'s Pacific services to North America since Qantas took the route over in May 1954. Radio officers were carried "in an advisory capacity" and pilots were specially instructed in long distance communications techniques, operation of the equipment and fault-finding. The system was evaluated by the Australian Department of Civil Aviation during this trial period, and the Director General of Civil Aviation has now given his approval for withdrawal of specialist radio operators.

The Super Constellations which operate the majority of the Australian carrier's international services are equipped with two Collins 618S HF transmitter-receiver units, which incorporate automatic tuning and loading of the transmitter to the aircraft aerial, and are claimed to be the most modern equipment of their type. In addition, the aircraft are to be equipped with cockpit loudspeakers and Selcal, which enables a ground station to call any aircraft within a radius of 1,500 miles by operating a light on the pilot's panel and a bell or buzzer. The device makes it unnecessary for a pilot to wear headphones continuously.

T.W.A.'s INDIA-JAPAN APPLICATION

IN a petition to the Civil Aeronautics Board T.W.A. have asked for a re-hearing of their application to operate a route between India and Tokyo. The application was denied by three votes to two when heard by the C.A.B. on December 15th last.

When allocation of overseas routes to the American flag carriers took place in 1946, T.W.A. were awarded a route from India to Shanghai. The present application requests permission to serve Tokyo as an alternative terminal until it becomes possible to operate to Shanghai.

CORPORATION APPOINTMENTS

SEVERAL staff appointments have recently been announced by the two Airways Corporations. In order to strengthen B.O.A.C.'s engineering group, and as part of a policy to advance the training of staff for managerial positions, **Mr. J. L. Uncles** has been appointed assistant on the staff of Mr. C. Abell, deputy operations director (engineering) and Mr. M. W. Anderson takes up a similar post on the staff of the chief development engineer.

Now in America, where he is directing the work of conversion of B.O.A.C. Stratocruisers, Mr. Uncles was formerly deputy design superintendent. Mr. Anderson, who served with the R.A.F. as a pilot during the war, has been project engineer, Britannias, at Bristols since 1949. This latter appointment now goes to Mr. W. Spencer, who has been assisting with the development of B.O.A.C.'s Argonauts, Hermes and Comets and more recently of the Viscounts ordered by Iraqi Airways, a B.O.A.C. associate.

The new B.E.A. appointments are as follows: Mr. R. C. Pinfield, station superintendent at Rome for the past two years, becomes responsible for all passenger traffic and cargo handling at London Airport, Waterloo Air Terminal and Gatwick. Mr. H. N. Murray, traffic manager (London) since 1952, has been appointed cargo service manager. The B.E.A. manager in Norway since 1951, Mr. W. O. Lloyd, has now been appointed manager for Malta and North Africa. His Norwegian appointment is now filled by Mr. L. H. G. Kent, formerly deputy station superintendent at Northolt. Mr. W. A. Caro, who has been B.E.A.'s manager in Sweden since 1951, has taken up the equivalent

Competing with the Viscount-equipped State airline T.A.A. are Australian National Airways, who have lately taken delivery of two new 58-seat DC-6Bs. These aircraft, one of which is shown (left) are used on the Melbourne-Adelaide-Perth route.

The aeroplane

The Westland S.55 10/12 Seat Helicopter has already revolutionized many aspects of military and civil transport. With auxiliary fuel-tanks it has a ferry range of over 1,000 miles; in Korea and elsewhere it has been outstandingly successful as a troop transport, ambulance, general reconnaissance and liaison vehicle, in air-sea rescue, and in dozens of other vital roles. It is powered by the 800 h.p. 7-cylinder Wright R.1300 Cyclone or by the 600 h.p. 9-cylinder Pratt and Whitney Wasp R.1340. Maximum speed at sea-level (T.O. rating) is 95 knots at 202 rotor r.p.m. Service ceiling is 11,000 feet. All-up weight is 7,500 lb. Main rotor diameter is 53 feet, and minimum length 42 feet 2 inches.

The pilot

BRADLEY, Lt. Commander Roy, R.N.V.R. He left the Bristol Aeroplane Company to join the R.N.V.R. in 1941. He served as a Naval test pilot, and was in command of Command Flight, Donibristle. On release he joined Helliwells Ltd. as Chief Test Pilot, and in 1950 joined Westland Aircraft Ltd. as experimental test pilot. He is a member of 1834 R.N.V.R. Air Squadron, Yeovilton. Wherever he goes in Britain he relies on Shell and BP Aviation Service.

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On all major airfields in Britain, the pilots of any type of aircraft now take for granted the familiar sight of a Shell and BP refuelling truck. They know — and all manufacturers of aircraft know — that all their fuelling and lubrication requirements will be met with certainty and dispatch by the efficient operators of Shell and BP Aviation Service.

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Flight deck of H.M.S. EAGLE, Britain's largest and latest Fleet Aircraft Carrier, taken during her spring cruise.

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David Brown-built O.H.V. Diesel/Petrol Engines.

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Weston Instruments are fitted to every Westland machine.

This Solent 3, pictured at Rose Bay, Sydney, is one of two sold to South Pacific Air Lines by Trans Oceanic Airways. The former company, with headquarters at Honolulu, plans to operate the boats to the southern Pacific islands, notably American Samoa.

CIVIL AVIATION . . .

appointment in Spain, replacing Mr. F. H. Nalder, the Corporation's new manager in Greece. The Swedish appointment vacated by Mr. Caro is filled by Mr. H. R. Roberts, formerly assistant to the B.E.A. manager in Rome. Mr. A. C. Mills has returned from Greece, where he acted as B.E.A. manager for more than eight years, to take up duties in the sales branch.

BRITANNIA DEVELOPMENT NEWS

EMPLOYEES of the Bristol Aeroplane Co. are given a frank assessment of Britannia progress in the spring issue of the company's house magazine *"Bristol" Review*. Referring to the first production aircraft's recent flight to Africa the journal says: "G-ANBA's fine performance should serve as a spur to us to maintain progress on the Britannia" and continues: "How, really, are we doing on this score?

"The answer turns on three things—aircraft performance, the fuselage fatigue test newly prescribed as a result of the Comet inquiry, and the accumulation of flying hours.

"On performance, there is—happily—nothing but good to report. The full reports of the preliminary tropical trials carried out by G-ALBO, combined with experience on the more representative G-ANBA, give good reasons for saying that design expectations are being met or bettered.

Mr. D. S. Stewart.

"On the fuselage fatigue test in the water tank at Farnborough it is early yet to speak. But at least we can say that we took time by the forelock and, with the Ministry of Supply, made the preliminary arrangements for the tests many months ago. Those arrangements have gone according to schedule, thanks not a little to the full and enthusiastic co-operation of those at Farnborough; the tests are just getting under way—and we are encouraged by official opinion to a sober optimism about their outcome.

"It is the accumulation of flying hours that is our chief headache.

"At the time of writing there is no official requirement about the exact number of hours that must be flown before obtaining a Certificate of Airworthiness, but with general assent we have undertaken a very stiff programme of flying—and up to the beginning of this month at any rate, we have not been piling up hours at the rate we should have liked to have seen. . . .

"The number of hours flown now in the middle of March is past the 1,000 mark, and we may hope that from now on it will build up steadily and at an increasing rate. . . ."

As a step towards expediting the test programme, an Australian engineer, Mr. D. S. Stewart, has been appointed Britannia development manager, with responsibility to the general manager of Bristol's Aircraft Division for Britannias engaged on development flying. Mr. Stewart, who graduated from the University of Queensland in 1940 with a degree in civil engineering, was technical superintendent of Australian National Airways until he joined Bristol earlier this year. Previously he served in the Department of Civil Aviation, where he was engaged first on the formulation of airworthiness requirements and performance standards, subsequently becoming supervising aeronautical engineer and acting superintendent of airworthiness. An enthusiastic private pilot, Mr. Stewart was for many years chief flying instructor to an Australian aero club.

AUSTRALIA'S SIXTH VISCOUNT

THE sixth Viscount for Trans-Australia Airlines, VH-TVF, left London for Melbourne on April 3rd and was due to arrive six days later. Commanded by Capt. Moray, the aircraft carried a crew of four and had two passengers—Mr. Frank Austin, technical representative of T.A.A. in England, and his wife. This Viscount is the first to be equipped with external slipper tanks, which enable it to operate regularly with a full payload on the 1,320-mile Adelaide-Perth route; T.A.A. were planning to put the aircraft to work on this route immediately after arrival. Spares carried to Melbourne include similar tanks for the fifth T.A.A. Viscount, already delivered, which has all the internal modifications required for the extra tankage.

SAVING SPACE

WITH the object of speeding up transit time at overseas airports, B.O.A.C. are experimenting with a system of loading "space boxes"—empty cardboard cartons—in the freight compartments of aircraft leaving London Airport. The purpose of carrying these boxes is to reserve a physical rather than a theoretical space for cargo booked at transit stops. B.O.A.C. explained that volume, rather than weight, is often the critical factor, and that by this means it is hoped to prevent overlap of space allocations, which have previously been based on the weight of the loads to be uplifted *en route*.

BREVITIES

THE M.T.C.A. announce approval of an application by Eagle Aviation, Ltd., to operate an inclusive tour service between Blackbushe and Pisa, with a technical stop at Lyons, until October 31st, 1955.

* * *

The vice-president (traffic and sales) of Pan American, Mr. Wallis G. Lipscomb, forecasts that a 50 per cent increase in transatlantic air cargo business should result from the new rate structure adopted by I.A.T.A. carriers. He estimates that the new rates, effective from July 1st next, will reduce from 32 cents to 26 cents per ton-mile the average charge for commodities representative of 75 per cent of transatlantic cargo business.

* * *

Next month B.O.A.C. will operate their first-class service to Hong Kong and Tokyo with 38-seat Constellations in place of 40-seat Argonauts. In preparation for this change a Constellation proving flight left London on April 5th for Tokyo and was due to begin its return flight on April 13th. Its occupants included Captain I. R. Stevens, acting manager of the Constellation fleet, and 15 other captains. The aircraft was scheduled to make practice approaches and landings at Beirut, Kuwait, Karachi, Delhi, Calcutta, Bangkok, Hong Kong and Okinawa.

* * *

Additional provision of instrumentation by Smiths Group companies is called for in some of the latest Viscount contracts. B.W.I.A. have specified the Kelvin Hughes periscopic sextant (Type 1A), and C.A.A. will use the same company's drift-meter, now undergoing service trials; Hunting-Clan Viscounts will carry both types of equipment. The Indian and Pakistan Air Force Viscounts will have the periscopic sextant and air position indicator, and Airwork's aircraft will be fitted with the Kelvin Hughes gyro-magnetic compass.

* * *

Finnair will open a Convair service between Helsinki and Hamburg on April 17th. The route will later be extended to serve Paris and Amsterdam.

* * *

Flown by two sons of manufacturer William T. Piper, a twin-Lycoming Piper Apache completed a 12,500-mile delivery flight from Pennsylvania to Pretoria on March 26th. The aircraft, illustrated in *Flight* last week, was fitted with extra tankage holding 200 gallons, permitting it to make the 1,860-mile South Atlantic crossing from Brazil to Liberia in one hop. Six more Apaches will be air-ferried to South Africa this summer, and others will fly the Atlantic for delivery to European purchasers.

* * *

Air-India International will introduce a weekly London-Tokyo service on April 22nd. Eastbound flights will leave London on Fridays and arrive in Tokyo two days later; return flights will leave Tokyo on Mondays. The new service has been made possible by extending to Tokyo the existing London-Hong Kong route, which calls at Dusseldorf, Cairo, Bombay, Calcutta and Bangkok. The frequency of service between London and the Far East, now four times weekly, is expected to increase to six by July.

The tricolour flew at Shoreham, Sussex, for the H.D.32's demonstration visit on April 3rd. Its remarkable short-field performance was proved beyond doubt, and steep turns at take-off showed its low-speed docility. New features to be noted are the added fin area and the perforated air-brakes, which are embodied in the main-undercarriage fairings.

"Flight" photographs

CIVIL AVIATION . . .

H.D.32 VISITS SHOREHAM

SOLID progress has been made with the Hurel-Dubois formula for a DC-3 replacement since the first flight of the prototype H.D.31 in December 1952. Two prototypes of the more powerful H.D.32 have taken the air; some 1,000 hr of test-flying have been amassed; Air France have placed an order for 24; and the French Navy have expressed the intention to buy over 100 examples of an anti-submarine version. An agreement for production and development of the H.D.32 has been reached with S.N.C.A.S.E., who will make first deliveries to Air France next year.

A less tangible but nonetheless important achievement of Hurel-Dubois has been the breaking-down of psychological objections to the unorthodox appearance of the aircraft. In the project's early days, the H.D.32 probably received less than its fair share of study from airline operators for this reason alone. Had it been offered by an aircraft of conventional wing-form, the performance of the H.D.32 would undoubtedly have been appreciated earlier.

Today, however, there are signs of much firmer interest on the part of airlines. The doubts felt on first sight of the H.D.32's spidery wing have been dissipated by familiarity, and better understanding of the reasons for adoption of the extremely high aspect-ratio.

Such, at least, was the impression we formed at Shoreham on April 3rd, when the first prototype H.D.32 was demonstrated in latest form. Airlines represented included B.E.A. (whose chief executive, Mr. Peter Masefield, flew the aircraft), B.O.A.C., A.N.A., Hunting-Clan and Skyways. B.O.A.C.'s observer was Mr. Whitney Straight, deputy chairman. This Corporation's interest in a short/medium-stage aircraft would, of course, be explained by its rôle as adviser to associate companies.

Following the Shoreham demonstration, the aircraft visited Blackpool Airport, where it was flown by Skyways' chief pilot, continuing—at the request of Aer Lingus—to Dublin.

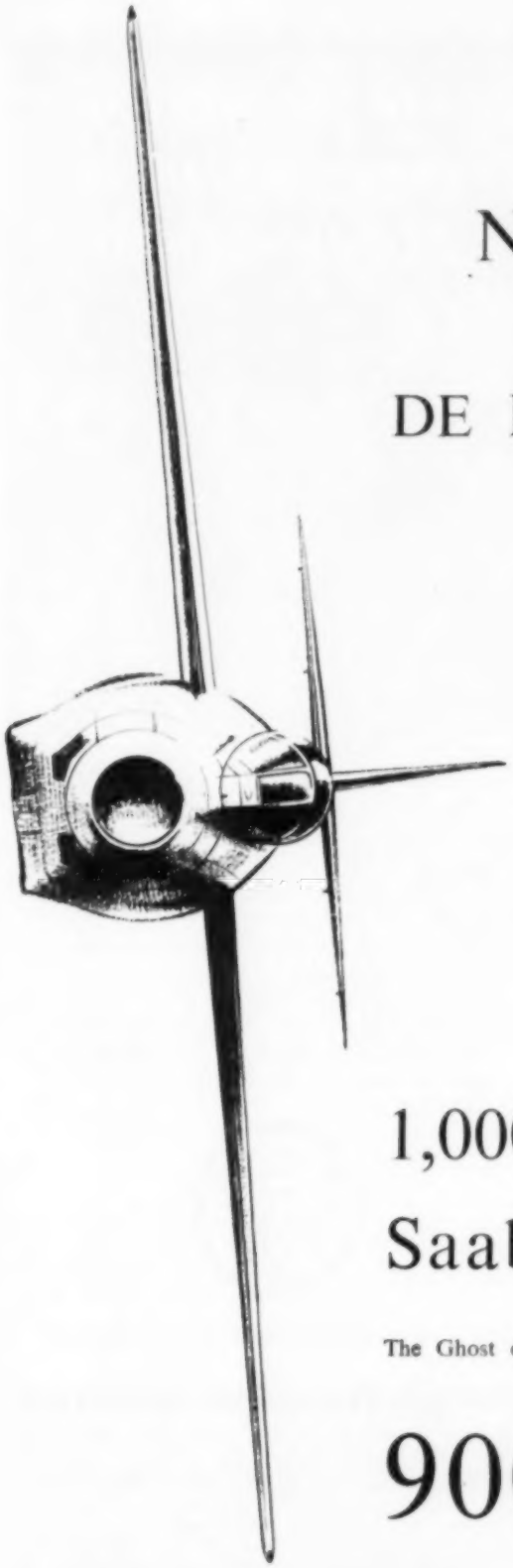
To improve stability in turbulent air, the H.D.32 now has additional tail area in the form of a small, shield-shaped fin on each tailplane and a keel-type fairing beneath the main fin. Perforated, door-type air-brakes are incorporated in the pylon fairings for the main undercarriage legs. Extending at 90 deg to the airstream, these brakes give a steeper angle of descent when approaching small fields with surrounding obstructions, thus shortening the required landing distance. Both the extra fin area and the brakes will be standard features on production H.D.32s. Another modification observed at Shoreham was the addition of a blister, housing the cabin heater, on the under-fuselage between the main wheels.

The cabin, finished in Air France colours, has 16 seats along the starboard side, with an automatic observer amidships to port. Though trimmed, the fuselage walls are not soundproofed, and our 20-minute demonstration ride along the Sussex coastline proved a somewhat noisy affair; the inboard exhausts of the 1,200 Twin Wasps produced a continuous, staccato hammering not unlike a pneumatic drill. Cmdt. Hurel assured us, however, that normal cabin insulation will cure this problem. In other respects the flight was most impressive; short take-off and landing, and marked stability and smoothness under cruising conditions.

Summarized briefly, the major claim made for the H.D.32 is that, using the same engines as the DC-3, it will lift twice the payload from smaller fields and will carry it at the same speed for at least equal distances. Figures quoted for the standard, Twin-Wasp-powered version of the H.D.32 are: stage-length (A.T.A.) of 600 miles with 11,300 lb payload, or 1,200 miles with 9,400 lb payload; speed, 168 m.p.h.; take-off run at 39,690 lb to clear 36ft, 860 yd (1,200 yd with engine-cut at safety speed). The H.D.32's slow-flying characteristics are probably better than those of any commercial aircraft of comparable size: the published stalling speeds (full flap) are 59-72 m.p.h, according to weight.

Arrangements for the H.D.32's recent demonstration in this country, and an earlier appearance by the H.D.31, were made by F. G. Miles, Ltd., who have just announced a further development of their agreement with Hurel-Dubois. To show the advantages of the H.D.-type wing, Miles propose to fit an Aerovan with a new high-aspect-ratio metal wing of 75ft span, instead of the wooden wing of 50ft span. The original Cirrus Majors, and all other features of the Aerovan, will be retained. It is hoped that the new wing will confer a positive single-engined performance, and that the original two-engine performance will be retained at an a.u.w. 400 lb. higher.

At Hamburg, Lufthansa's flag is broken to signify the post-war revival of German air transport. As reported on pages 472-3 of this issue, domestic services began on April 1st.



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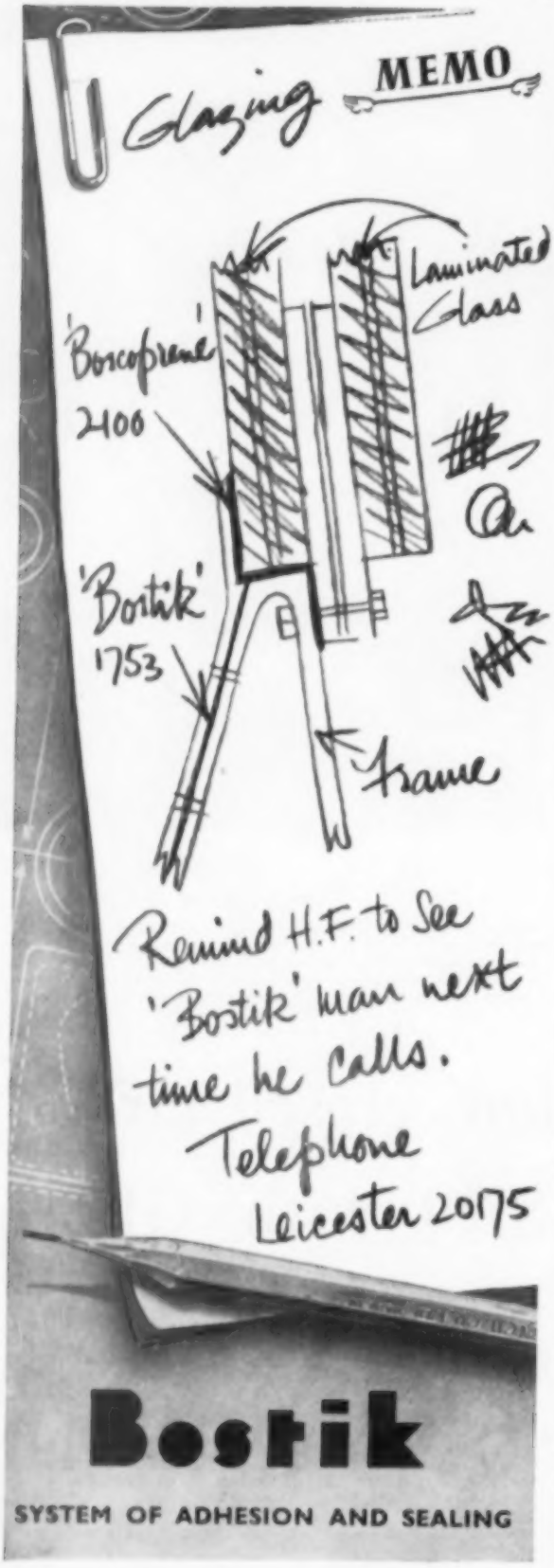

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A4758

THE DEUCE

English Electric's Digital Computor

The main units of the Deuce are here shown set up for operation. The Deuce has already assisted in the solution of Canberra aerodynamic and structural problems, and in the immensely more complex problems of the P.1 supersonic interceptor and guided missiles.

WHEN, shortly after the end of World War 2, the National Physical Laboratory wished to develop an electronic calculating machine of greater potential than any built previously, they sought assistance from the English Electric Co., Ltd. Scientists and engineers from the latter co-operated with the N.P.L. to such effect that the pilot-model ACE (Automatic Computing Engine) was put "on steam" at the N.P.L. mathematics division early in 1952, since when it has proved outstandingly successful.

Naturally enough, the English Electric Company, finding itself with an immeasurably valuable team of workers completely versed in the development problems of large computors, decided to embark upon the development and production of advanced forms of electronic computor as a commercial proposition. Certainly, there are few organizations which can hope to rival the English Electric Group in range of technological skills, and even fewer which could hope to carry through such a programme.

The first computor marketed by the company is known as Deuce (Digital Electronic Universal Computing Engine), and is virtually a "custom-built" fully engineered version of the ACE, embodying all the lessons learned in the development of the earlier equipment. Basically, Deuce is fairly straightforward, but it is exceptionally versatile; the company believe it to be "the most powerful and most competent electronic calculating machine in Europe."

In common with most large digital machines, Deuce has two "memories" or storage capacities. The bulk store is a magnetic recording drum, on which can be "written" 8,192 "words," or more than one-quarter of a million digits, on 256 tracks. The drum has two sets of writing or reading units, each with 16 heads which can be moved into any of 16 positions, giving access to the required track in 25 milliseconds. For much more rapid operation, required by the computing circuits themselves, information actually in use is stored in mercury delay lines, of which 12 can each store 32 "words" and 10 are shorter lines filling the role of accumulating registers and similar functions.

Optimum coding is employed, i.e., each instruction includes information on the timing and duration of current transfer and the position in the store from which the next instruction is to be taken. Consequently, elementary operations (such as addition) can be performed within 64 μ seconds; multiplication and division require two milliseconds, during which time the other functions of the machine can carry out other operations.

The first examples of Deuce are equipped for control by punched cards of standard 80-column type. Input and output units "read" at 200 and 100 cards per minute, respectively, and data can automatically be transferred to, or from, non-decimal form, such as sterling. If required, the input and/or output can be of a different character, such as punched paper tape or magnetic tape.

Although careful attention has been paid to considerations of accessibility and ease of replacement of defective parts or circuits, the whole computor can be installed on a floor area 14ft by 4ft 6in, with the exception of the mercury delay lines which are housed in a thermostatically controlled drum 3ft in diameter and 3ft 6in high located a suitable distance away. All the 1,300-odd valves are of standard miniature patterns, and isolation from the supply mains by a motor-alternator set is unnecessary. A point of particular note is that marginal checking circuits are provided which can, in a few minutes, steadily narrow down and finally locate the source of any incorrect operation.

The first Deuce to be operated by the English Electric Company is at the company's works at Stafford. A second Deuce will be installed at the Group head office at Marconi House, London. Two more Deuces have also been made for outside purchasers: one for the National Physical Laboratory and the other for the Royal Aircraft Establishment, Farnborough. The capital cost of the Deuce is of the order of £30,000 to £40,000. In the course of time, the English Electric Company intend to establish a completely comprehensive data-processing business, fully comparable with that built up by one or two firms in the U.S.A. On the face of things, it would appear that the Group have an excellent chance of assuming a commanding position in this rapidly growing field.

The Group have announced their intentions and future policy in the field of digital computors in the following terms:—

(1) A computing centre has already been set up in the Nelson Research Laboratories at Stafford and a further centre will shortly be established in London. A Deuce computor will be permanently located at each of these centres and a team of skilled mathematicians and operators will be available to offer a full computing service to organizations not requiring a machine for their own full-time use.

(2) Where customers prefer to operate their own computational service the company will build Deuce computing machines for installation and operation within the customer's own organization. Productive capacity for the Deuce has already been absorbed for 1955 but the company can now accept orders for delivery early in 1956.

(3) The company is setting up a maintenance organization to provide a regular and expert service to ensure that these machines are kept in optimum condition.

(4) A training service will be available based on the two computing centres for initiating scientists, mathematicians and machine operators in the actual use of machines supplied to their organization.

(5) A library of information is being set up in which will be recorded the programmes and sub-routines which have been worked out for the solution of problems, and this information can be made available to customers if required.

(6) A development programme is in hand to add other information handling equipment—such as magnetic tape—to enable the machine to process different forms of mathematical and experimental data. In the future the company expects to extend the range and improve the performance of the machine and provide a comprehensive range of data processing equipment for all kinds of scientific work.

PHOTOGRAPHERS' FAIR

THE first British Photo Fair for 20 years is being held in London—at the New Horticultural Hall, Westminster— from May 16th to 21st. It will be the most comprehensive display of its kind ever staged, with 50 exhibitors and 100 stands showing what the British photographic industry has to offer.

One exhibitor will be the journal *Amateur Photographer*, which is co-operating with the organizers in providing a number of useful services. These include the organization of a series of daily lectures by famous photographers. Dr. Harry Baines, president of the Royal Photographic Society, will speak on *Colour Photography;* Baron on *Photographing Beautiful Women;* Barnet Saidman on *Journalistic Photography;* Angus McBean on *Theatrical Photography;* Walter Nurnberg on *Pictorial Lighting;* and a representative of Vogue Studios on the work done there. Accommodation is limited and seats will be allocated in strict rotation: application for tickets should be made to *Amateur Photographer*, Dorset House, Stamford Street, London, S.E.1, naming the lecture(s) which the applicant desires to attend.

The journal is also running a free photographic competition for which some £250 in prize money is being offered. Full details, together with a comprehensive guide to the exhibits will appear in a special "British Photo Fair" number of *Amateur Photographer* appearing on May 18th.

T.C.A. AND THE VISCOUNT

Background to the North American Début of a British Turboprop Airliner

APRIL 1st was an historic date in the history of Canadian air transport, for on that day Trans-Canada Air Lines inaugurated scheduled services with the turboprop Viscount on one of their domestic routes. Three days later T.C.A. Viscounts began regular operations to and from New York.

Here in London, despite the fast, frequent air services which have reduced 3,500 miles of ocean to half-a-day's travel, it is difficult to visualize the interest which surrounds the coming of the turbine-powered commercial aeroplane to North America. This interest, as we saw during a recent visit to Canada and the United States, is not confined to the airline executives and their staffs. Public consciousness of technical aspects of airline operations there is more highly developed than in Europe, and passenger-reaction consequently has a more important influence on both the production and the sale of air transport.

The cost of air travel in North America, relative to average earnings, is extremely low by European standards, and the great distances involved in both business and personal travel are an incentive to frequent use of the airlines. The "average" North American passenger, therefore, has become more discriminating in his judgment of standards of travel than his European counterpart. The airlines' market of some 30m passengers annually is large enough to sustain a considerable volume of Press, radio and television advertising, which ensures that every new development is publicized to the fullest extent. T.W.A.'s latest "Super-G" Constellation, for example, was the subject of whole-page advertisements in the New York dailies.

There is, in fact, not a great deal of variation between the services of the major carriers. Equipment is confined to a few piston-engined types of American manufacture and essentially similar characteristics (so far as passenger-comfort is concerned); and keen competition ensures uniformly high standards of attendance on passengers.

The advent of the Viscount completely alters this picture. The turboprop operator really has something *new* to offer, a fact which both T.C.A. and Capital Airlines have exploited to the full. Their preliminary campaigns have already generated a wide public desire to experience Viscount travel; one only has to stand for a few minutes at a T.C.A. ticket counter to hear an inquiry from a prospective Viscount passenger. It is, as yet, too soon to predict the effects of the Viscount's introduction on Canadian and American routes. T.C.A. will not be operating at full strength for several months, and Capital's initial services—due to begin in a few weeks—will be flown with a "pilot fleet" of three aircraft.

Our own guess is that B.E.A.'s impressive traffic increases on their Viscount routes will appear modest beside the proportion of new custom which the aircraft will win for its North American operators. In that event, the wider acceptance of turboprops for U.S. domestic operations would assuredly be accelerated by many months. Most carriers there still look to the West Coast to provide a medium-stage airliner of Viscount type (though somewhat larger capacity is required on the denser routes). The pressure of competition, however, favours Vickers' hopes of selling more Viscounts and, later perhaps, some form of "Super-Viscount."

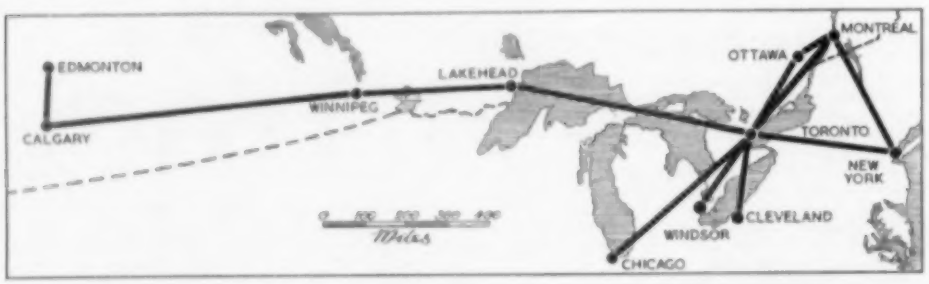
Meanwhile, the performance of the aircraft in the hands of its first North American operator is of immediate interest. The following notes outline the background to T.C.A.'s current programme of Viscount operations.

The T.C.A. Viscount Fleet, at the time of writing, consisted of five aircraft, with a sixth scheduled for delivery last week-end. Deliveries are being made by Vickers crews *via* Prestwick, Keflavik, Bluie West One and Goose Bay (a T.C.A. Viscount ferry flight was described in *Flight* of April 8th). By the end of June T.C.A. hope to have 14 Viscounts in operation. The 15th will be delivered later this year, and the initial order for 18 aircraft will be completed in the spring of 1956. The airline has an option on four more Viscounts for delivery in the spring of 1957, and this option is subject to increase.

Training. To enable the crew-training programme to go ahead with minimum loss of revenue flying hours, T.C.A. have made arrangements with the Canadian Department of Transport for the temporary loan of the D.o.T. Viscount, which reached Montreal on March 29th. Some 40 T.C.A. crews, each consisting of captain and first officer, are being trained on the Viscount; instruction is also being given to six Capital Airlines pilots. The conversion course consists of 18-20 hr flying time per crew and two weeks' ground school. Flight training will be completed by June.

Maintenance training began twelve months ago, when 14 servicing specialists came to England for Vickers and Rolls-Royce courses. On their return, they organized training classes at Winnipeg for a total of 450 ground engineers, of whom about 70 per cent had completed their courses at the time of writing. Fourteen Capital engineers and seven D.o.T. staff have also attended the T.C.A. courses. Two weeks before revenue services began, scheduled flights were inaugurated with the objectives of providing pilots and cabin crews with route experience, and of training line personnel in ground handling.

Operations began on April 1st with a daily return service between Montreal and Winnipeg *via* Toronto and the Lakehead



By midsummer T.C.A. hope to achieve more than 100 Viscount hours daily, operating 14 aircraft over the route network shown (left). Viscount services on the Winnipeg-Lakehead - Toronto - Montreal route began on April 1st; the Toronto to New York service followed on April 4th.

(Opposite) T.C.A.'s Viscount flagship makes its first appearance at Idlewild. On the right is shown some of the sales literature published to what the North American appetite for turboprop travel.

(the station which serves both Port Arthur and Fort William). The second phase in the Viscount's introduction was the replacement of North Stars on the Toronto to New York run. This is T.C.A.'s most competitive route, since it is also operated, seven times daily, by American Airlines. American offer four stopping services with Convairs and three non-stop DC-6 flights in each direction. The DC-6s, which are scheduled to cover the 366 miles between Idlewild and Malton, Toronto, in 1 hr 35 min, were brought in quite recently in anticipation of T.C.A.'s introduction of the Viscount. Formerly, the Canadian airline's North Stars, seating 48 passengers, covered the route three time daily in each direction; with the introduction of 40-seat Viscounts the frequency was stepped up to five return flights daily. Advertised flight time for the North Star was 2 hr 10 min compared with 1 hr 50 min for the Viscount (this is the block-to-block time; it will be surprising if the Viscount does not at least equal the times achieved by the American Airlines DC-6s).

Phase three, scheduled for mid-May, will be the opening of direct services between Montreal and New York, also at a frequency of five return flights per day instead of three. Flight time is expected to be 1 hr 35 min, compared with the North Star's 1 hr 55 min. T.C.A.'s competitors on this route—Colonial Airlines—now operate five DC-4 flights daily (advertised time, 1 hr 45 min) against T.C.A.'s three North Star services. In the following month the Winnipeg services will be extended west to serve Edmonton and Calgary, and midsummer should see the appearance of the Viscount at Cleveland, Windsor and Chicago. It is further intended to inaugurate Viscount services between Toronto, Ottawa and Montreal. The operation of this network presupposes a high rate of aircraft utilization—higher, probably, than has yet been achieved by any other Viscount operator. Assuming that 14 aircraft are in service by the end of June, T.C.A. then expect to be averaging 7 hr 40 min of revenue flying per aircraft per day.

Though the interior design of T.C.A.'s Viscounts enables quick conversion to be made from a 40-seat to a 48-seat layout, there is at present no firm intention to make use of the higher-density seating. Initially, the Viscount will be used only on first-class services and the airline is anxious to give its passengers the most comfortable cabin conditions compatible with operating economy;

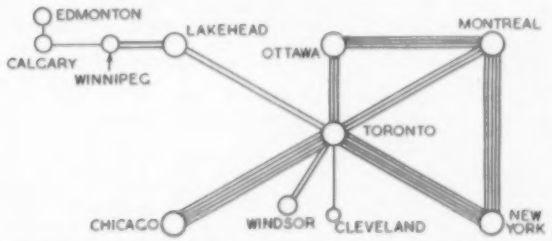


Chart showing the proposed frequency of T.C.A. Viscount services by midsummer; each line represents one return flight daily.

present indications are that a Viscount can pay its way over the T.C.A. network as a 40-seater.

Despite the great increase in productive capacity made possible by the acquisition of Viscounts, T.C.A. have not made any immediate plans for the disposal of DC-3s or North Stars. Between 1953-1954 the airline increased its passenger carrying by 10 per cent and this year it intends to offer some 25 per cent more seats. The North Star, in particular, is by no means at the end of its useful life. It will be used to an increasing extent on tourist services and, suitably modified, will be introduced this summer on a transcontinental freight run. Described in T.C.A.'s latest annual report as "one of the most reliable and economic air transports ever manufactured," the North Star is now being operated at an average utilization of some 12 hr daily.

After-sales Service. Whatever the merits of the Viscount, it could not be sold to North American operators without the assurance of full backing from manufacturers of both airframe and engines throughout its working life. The extent of Vickers-Armstrongs' and Rolls-Royce's interests in Canada and the United States shows that the question of after-sales service is well in hand, and that criticisms aimed in the past at the British aircraft industry's approach to this vital problem will not apply in the case of the Viscount.

It is essential that the operator should be able to call upon the manufacturer's advice at short notice, and that he should not feel separated by the thousands of miles which may lie between their respective head offices. In Montreal, Vickers have set up a central office, under technical representative N. J. Wadsworth, to control the activities of all the company service engineers resident with T.C.A. and to provide liaison between the operator and accessory manufacturers both in Britain and North America. At Winnipeg, the manufacturing company has established a $100,000 stock of spare parts in order to give over-the-counter service to T.C.A. A similar stock is being built up near Washington to meet the spares requirements of Capital Airlines.

The operators will also be relieved of the expense and complication of building up large stocks of engine spares. Rolls-Royce of Canada, Ltd., have set aside part of their modern, well-equipped plant at Montreal for this purpose.

Situated near Montreal's main airport at Dorval, this factory also has full facilities for the production and overhaul of turbine engines. Though these facilities will not be required in the case of the Darts used by T.C.A. and Capital, their existence undoubtedly does much to support the prestige enjoyed by the name of Rolls-Royce throughout North America. R.J.B.

ROCKET ENGINEERING

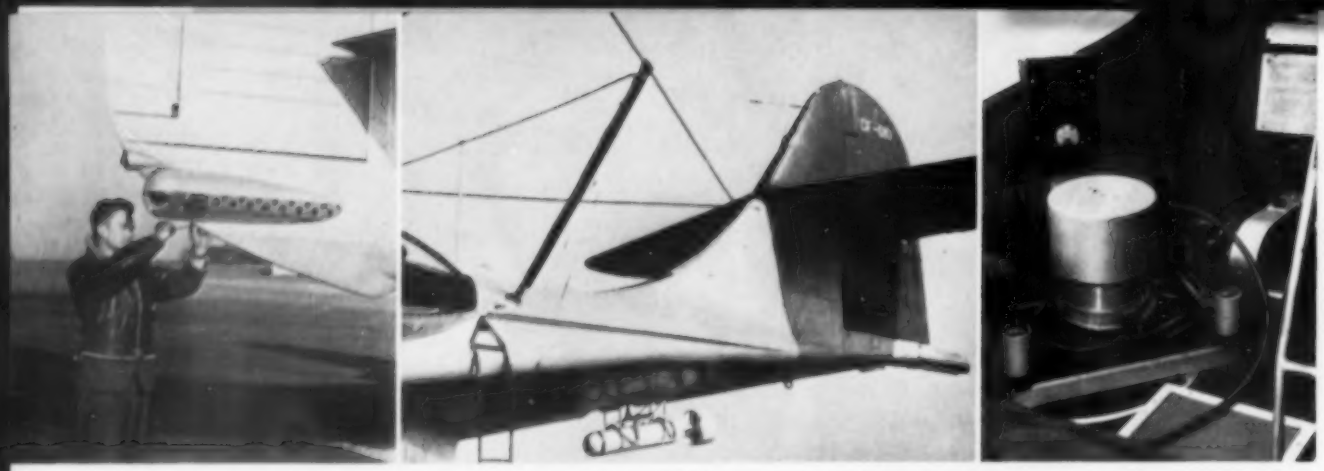
EVEN the old German V.2 rocket might have its range extended some five times if redesigned; by the use of kerosine instead of diluted alcohol as fuel, and of light alloys in place of steel, it could be made to reach an altitude of over 1,000 miles. This was one of the examples given by Professor A. D. Baxter, M.Eng., M.I.Mech.E., F.R.Ae.S., F.Inst.P., Head of the Department of Aircraft Propulsion of the College of Aeronautics, at a recent meeting of the British Interplanetary Society held in Manchester.

Explaining the parameters governing rocket performance, Prof. Baxter showed that the temperature of combustion and the mean molecular weight of the products of combustion could be interrelated. Mean molecular weight would be lowest when there was a large percentage of hydrogen in the jet, that is, with fuel-rich mixtures. Although under such conditions the temperature might fall below the maximum obtainable from the propellant combination, there was an increase in specific impulse over that resulting from a stoichiometric mixture. This arose from the reduction in mean molecular weight of combustion products.

A compromise had to be made between the high chamber-pressures which were needed for maximum thermodynamic efficiency and the additional weight of the nozzle required for complete expansion. The thrust of the motor consisted of the reaction resulting from the acceleration of the jet in the nozzle together with an additional term arising from the difference between nozzle exit and ambient pressure. The lecturer showed curves indicating that a nozzle should be designed for conditions part way along the powered trajectory, so that the overall efficiency throughout the trajectory would be maximum.

Although spherical or cylindrical rocket motors having convergent/divergent nozzles with an optimum half-cone angle of about 15 deg usually required an L^* (characteristic length) of 60-70in, throatless motors might operate with one of only 12in. A reduction in motor weight resulted, but such motors had the disadvantage of operating steadily only under design conditions.

Many people alive today would see the establishment of an instrumented satellite, said Prof. Baxter, supporting this forecast by showing how the performance of the V.2 could be improved. Peak altitude could be doubled by means of a specific impulse of 263 sec, which could be obtained by a better choice of propellants and the use of a combustion-chamber pressure of 40 atmospheres. More spectacularly, the peak altitude could be 1,100 miles if, in addition, the mass ratio was increased to 8.8.



Aircraft of widely differing sizes have been converted for geological survey work. Left: A magnetometer head in the tail of a survey Prince. Centre: The tail of a Canso specially modified in Canada, showing the aerial array for the transmitter coil of the electro-magnetic detector; the receiver element is in the "bird" seen in retracted position under the fuselage. Right: A scintillation counter mounted in an Auster.

The Importance of Air Survey

AT a "main" lecture meeting of the Royal Aeronautical Society on March 31st, Mr. T. D. Weatherhead, O.B.E., M.A., director and general manager of Hunting Aerosurveys, Ltd., gave a convincing and detailed summary of the requirements for, and possible results of, aerial survey in relation to the economic growth of under-developed countries.

He explained how both topographical and mineralogical information, in some detail, was a natural pre-requisite for the successful implementation of almost any scheme of economic development. He gave six main reasons why, in his view, a new approach was required to the problem of economic development, which, he said, had far outpaced the gathering of the background information upon which it must necessarily be based. The first reason was that an industrial revolution had produced rapid means of communication, thus rendering much more easy both the dissemination of information and the comparison of states of development in various parts of the world. The second was political—the growing strength of nationalism, which required an independent economy and a broader basis for a small nation's livelihood. The third factor was economic—the universal demand for an increased standard of living. The fourth was moral—the conscience of the Western world in view of the comparatively low living standards of the under-developed countries. The fifth was again political—a division of the world into two camps, each striving to bring the less-determined territories under its wing. Finally, the sixth was the rapidly increasing world population, which demanded better use of resources as well as an interchange of materials.

The speaker went on to show how a large number of organizations depending from U.N.O., the United States and Great Britain were engaged in assisting development all over the world. He quoted the particular case of the International Bank and showed that it had been found that a development plan must be based on an accurate knowledge of natural resources and topographical details. No plan for national industrial development, he maintained, could ignore the purely natural resources in a country, both agricultural and mineral. The International Bank had therefore established an Institute for Development designed specifically to deal with the collection and study of such information in countries where the Bank was financing development schemes. This, however, was only typical of measures which had been taken in practically every case where schemes had been initiated—and the critical shortage in nearly every case was of maps. Even in such areas as Ceylon and Pakistan, where survey departments had existed for many years, the information collected was comparatively restricted, and the lecturer implied that the areas surveyed could be greatly increased by the use of vertical mapping photography from aircraft.

This in itself raised its own problems, however. It was important to determine the scale which was required in order to make it possible to obtain the right information in conjunction with work on the ground. In some cases a photographic mosaic could form a substitute for a complete map. The speaker described a project undertaken by the Canadian Government under the Colombo plan for the air mapping of a large area in Pakistan. There, as in many other cases, the requirement was for a land classification survey to show the use which was being made of land, the resources which it held, and to suggest a programme for their efficient development. Resources, of course, were not only mineral but could include also such things as timber and soil composition.

In such cases, air survey had been found to be sufficiently accurate, and quicker and up to 25 per cent cheaper than the survey carried out on the ground.

Finally, Mr. Weatherhead dealt with mineral survey from the air, particularly in relation to the search for oil. (Hunting Air Surveys in Canada have, of course, carried out considerable development work in this field and they equipped a Canso amphibian to make a combined survey with an airborne magnetometer, a scintillation counter, and an electro-magnetic detector. This aircraft was described in *Flight* of December 31st, 1954.)

BRITAIN'S AIR PRESTIGE IN AMERICA

A READER now resident in the United States is concerned at what he feels to be a serious lack of publicity for British aircraft in North America. He has sent us this contribution, in which he sets forth his views on the subject.

IN the United States, during the past twelve months, the prestige curve of the British aircraft industry has taken a sharply defined dip. Nearly every aspect of British aeroplane manufacture has come in for more than a normal share of criticism and, worse, there is no tangible evidence to show that Britain is doing anything to restore her good name in this field. Indeed, there is not even a ready suggestion that she yet realizes what is happening to her air reputation overseas.

There was a time, I suppose, not so long ago, when British indifference to world opinion was a carefully nurtured tradition. But that was in the days when she could afford such luxuries, and defend them. Now, with vast technological advances being announced, virtually day by day, and from the four corners of the globe, the competition in any branch of technological excellence cannot sensibly be ignored.

There is a further consideration (which, although it is a semi-political one, I hope may not offend my readers) that is of no small importance in connection with the decline of Britain's air prestige. It is, simply, that any national achievement, or failure, is measured in terms of international influence. That is a sign of our times that should not lightly be dismissed. Britain, in her "come-back" struggle to the front rank of world affairs, is not helping her other diligent efforts by treating her international "certificate of airworthiness" as a matter of little consequence.

It can be argued, and not without some justification, that most of the adverse publicity directed at British aircraft and the British industry is to be found in the columns of America's non-technical, popular Press. Some of the gentlemen who write for the weekly news magazines in the United States have a peculiarly inverse reasoning that automatically converts someone else's loss, real or fabricated, into an American gain. Nevertheless, this fact alone should not be allowed to breed complacency.

Some British opinions seem to suggest that technical America still recognizes the engineered perfection of the British product and, therefore, that American public opinion can be safely ignored. Perhaps! Unfortunately, technical America also recognizes one other thing of which British manufacturers still seem to be remarkably unaware. That is, that technical America appeals to the very same markets as its transatlantic cousins. It is not very likely that American engineers, despite the fraternal cameraderie which is supposed to transcend national boundaries, are going to over-praise their competitors.

It is true that, up until a year or so ago, British aviation did hold a universally high place in American esteem. It might not be

an exaggeration to say that Great Britain's leadership in the air, then, was accepted as readily as once had been her supremacy on the seas. Much of this favourable attitude in U.S. opinion was a carry-over from 1940, when the American dailies headlined, as only American dailies can headline, the achievements of "the few." Partly, it was attributable to the widely held, if erroneous, belief that the jet aircraft was invented in Britain.

A great deal of Britain's air prestige in America could be traced to the fact that the first jet transport to get off the ground bore British markings. Yet again, the turboprop developments were hailed with enthusiastic good wishes and when it became known that NATO was to equip with British fighters, American heads nodded in satisfied approval. But then, what happened? Firstly, the Comets crashed.

No one, of course, has the slightest ground for criticizing the way in which the investigations of those tragic disasters were conducted. In the circumstances, grounding and exhaustive research, with all the cards on the table regardless of outcome, was the only possible path of action. That, in the process, the news agencies of the world should feature the Comet failure, rather than the scrupulous honesty and sacrifice inherent in the inquiry, was not the least of the misfortunes that British aviation suffered. But as a direct consequence of the Farnborough findings, British aviation as a whole endured a long—and, from a factual standpoint, an almost slanderous—attack in a vast section of the American Press.

I have intimated that, if this were the price of investigation after Elba and Naples, then it was a price that had to be paid. My main contention, however, is that now Britain has paid she should not be content to let her air reputation dwindle without doing something quickly and positively to restore her prestige, at least to a competitive level.

It is indeed encouraging to learn that Comet 4s may be flying passenger routes again by 1958. But can Britain afford to wait that long before attending to her "good name"? It seems unlikely. The development of the Boeing 707 is being pushed ahead with all speed. Quite obviously, the American company gave thorough consideration to the Farnborough findings. Many imponderables of jet aviation are now understood and answers have been found for them. It is, perhaps, not unfair to state that, because of Farnborough, Boeing will be able to put the 707 in the air ahead of schedule and decidedly with a less troubled conscience. By the time the Comet 4 is flying, and, moreover, has flown itself back into the confidence of the paying passenger, the Americans may well be on the road to as great a domination of the jet routes as that which they now enjoy in piston flight.

The bright spots on the present dark canvas of British aviation in America are the advent of the Vickers Viscount and Bristol Britannia. It becomes increasingly clear, from this long view, that these aircraft must carry the flag back to the Western Hemisphere.

The announcement of substantial orders for the Viscount by both Canadian and American airlines does a great deal to offset such glaring criticism of British aviation as the following, which appeared in an influential news weekly. This publication, taking what has become an all too familiar attitude towards the British industry, said: ". . . . whereas Britain's flashy prototypes dazzle the airshow crowd at Farnborough, the production models rarely come up to expectations."

The Viscount's story can be told, but only by intensified publicity and advertising campaigns. But should Trans-Canada Airlines and Capital Airlines (the lone North American companies, thus far, with the confidence to order these machines) be expected to bear alone the cost of campaigns that eventually must benefit the British aircraft industry as a whole? [T.C.A. publicity material is illustrated on p. 503.—Ed.]

To begin with, it is doubtful whether any one commercial company can, by itself, do the public relations job that British aviation now needs to have done in the U.S. Instead of single and unconnected attempts at public relations, such as the Hawker Siddeley Group advertisements and the Trans-Canada and Capital advertisements, the British industry and the purchasers in North America should combine forces behind one cogent fact. And that fact is the sale and success of the Viscount (and, no doubt, later on, of the Britannia too) in the Western Hemisphere.

This "success story" should be the nucleus around which the reputation of British aircraft is rebuilt. It should not, of course, stop with two airliners nor, for that matter, with the American market. With an eye to the rapidly approaching future, the story of British jet development, from its inception to the present, should be fully publicized. The Comet and its contributions to man's knowledge of jet flight, tragic as the details surrounding some of those contributions were, should be fully described in a series of well-placed messages that stress the facts of Farnborough. It should be made clear that, in a very real sense, the Comet affair was to the ultimate benefit of all. No opportunity should be cast aside in which Comet 4s can be promoted as the answer to the Mediterranean debacle.

Britain's air reputation can be regained, indeed, must be regained. But it is unlikely to show the much-needed quick improvement unless the British aircraft industry as a whole is willing to tackle the problem of prestige with the courage and the confidence that its past, present, and future products justify. A.B.T.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Deck-landing Floatplanes

IN his letter published with photographs in your issue of February 11th, 1955, J. W. R. Taylor asked if any reader could supply details of the deck-landing of a Swordfish floatplane. He may be correct in saying this happened before the Dakar operation, though I never heard of it. However, it certainly happened to me, and readers might be interested in the circumstances.

During the action against the French Fleet at Oran, I was catapulted from the battleship H.M.S. *Valiant* to spot for the fleet's gunnery.

During the fight the French battleship *Strasbourg* escaped and *Valiant* was sent to intercept her and bring her to action. *Valiant*, therefore, had no time to stop and pick me up, and instructed me to try my luck with the *Ark Royal*. The latter ship decided to accept me, cleared her flight deck, and I landed-on.

Beyond a few holes in the undersides of the floats the aircraft was undamaged. I remained in the ship until she subsequently returned to Gibraltar.

The Captain of *Ark Royal* was not with me. He had earlier gone ashore in a motor boat to parley with the French and to persuade them to come over to our side. An alternative was for them to steam their ships to the West Indies and agree to being neutralized there for the remainder of the war.

As is well known, his mission was unsuccessful and the ensuing slaughter and useless blood-letting was unfortunately necessary.

R.N. Air Station, Donibristle. H. S. M. DAVENPORT,
Lieutenant-Commander, R.N.

The Channel Wing

AS you know, the 2½-ton CCW-5 (Custer "Channel Wing") recently made several flights of unusual performance and I am eager to obtain the British viewpoints on this remarkable innovation for economical power application with utilitarian performance. Although our American magazines noted the flights, we as a people are slow to appreciate the unusual until we trip over it or it is forced upon us; and I believe that knowledge of the capabilities of a channel wing, when tempered with conservatism, will be an eye-opener to those who base any design improvements on "available subsidy."

The most memorable of my personal pilot experiences—not even excepting my first solo—was the first flight I made in a Westland Lysander; and this pleasant awakening to a slow-flying, fixed-wing aircraft with true utility value has greatly influenced my outlook on the developments of the aviation industry. I believe that if one per cent of airfield development costs in the last 20 years had been spent on improvements to this type of aircraft it is possible that the industry today might be completely self-sustaining on its relative merits, and that the need for runways would be past.

Since England, to use the airplane to best advantage of all her people, must limit the size of her runways and budget her aviation development to practical achievement, there is an excellent possibility that the channel wing provides the asset necessary to ensure her leadership in design of economical, high-performance transport aircraft. Certainly the use of by-pass airflows, in which England leads the world, is a natural supplement to a channel-wing installation.

Today we are letting military needs divorce the airplane from the people as steadily as we are replacing the wing with power, and we are also contemplating complete prostitution of the helicopter's excellent virtues by altering it to approach performance available two decades ago in fixed-wing aircraft. Unfortunately, few American aircraft approached the Lizzie's performance and its long range value may have been overlooked, due to imminent needs restricting the foresight of the design planners. The consensus of opinion seems to be that with the application of enough power we can hold ourselves up by our bootstraps, and if

CORRESPONDENCE . . .

the trend continues on this uneconomical premise we may soon be required to go barefooted. As the power increases, it is only as reliable as the electronic valves replacing the pilot—who, indeed, will find another medium of travel rather than ride a "missile."

Aircraft design, in general, has advanced only as the availability of the power required to push the vehicle, and if continued on the present trend will cause the airplane to evolve into only a control surface for directional control of some motivating force. Unless soon influenced by conservatism the designers will design themselves right out of a job. Although they accept loss in propulsive efficiency at low speeds they do not seem to comprehend that the volume of air being by-passed inefficiently could supplement the thrust losses by supplying lift. The simplest method of putting this wasted airflow to work appears to be with a channel; and use of a channel would at the same time provide the additional feature of engine accessibility.

It appears to me that simplicity and practicality are too frequently being overlooked as the industry "advances" in design experience, probably due to lack of field experience of the design planners. When it is considered that the performance attained by the publicized channel-wing aircraft has been accomplished by laymen with limited experience and low funds, I believe the results obtained justify additional unbiased consideration being given to the capabilities of this wing. Constructive criticism would be welcomed.

East Hartford, Conn., U.S.A. DEL SANTEE.

FORTHCOMING EVENTS

Apr. 15. Helicopter Association: "Noise Problems in Helicopter Design," by Prof. E. J. Richards, M.A., B.Sc., F.R.Ae.S.
Apr. 15. Scientific Instrument Manufacturers' Association: Annual Dinner and Dance, Dorchester Hotel, London.
Apr. 16. British Interplanetary Society (North West Branch): Film show.
Apr. 19. R.Ae.S. Section lecture: "Thermoelasticity," by Prof. W. S. Hemp, M.A., F.R.Ae.S.
Apr. 19-21. R.E.C.M.F. Radio Components Show: Grosvenor House, London.
Apr. 20. Women's Engineering Society: "Industrial Trends in the U.S.A.," by speaker from U.S. Information Service.
Apr. 20. Institute of Welding: Annual general meeting, followed by film and light entertainment.
Apr. 21. R.Ae.S. Main lecture: "Aeronautical Research in Sweden," by Major Bo. K. O. Lundberg, F.I.A.S., F.R.Ae.S.
Apr. 23. British Interplanetary Society (Provisional Yorkshire Branch): "History of Rocketry," by L. S. Strickson.
Apr. 24. Denham Flying Club: Tea patrol.
Apr. 26. Institute of Transport: informal luncheon.
Apr. 26. R.Ae.S. Section lecture: "Aerial Systems for Aircraft," by R. A. Burberry.
Apr. 30. R.Ae.C.: First National Air Races meeting, Fairwood Common, Swansea.
Apr. 30. Institute of Welding: "Oxy-acetylene Pressure Welding of Aircraft Undercarriage Components," by J. J. Wilson and D. C. Brown.

R.Ae.S. Branch Fixtures (to April 28)

April 19, *Belfast*, Annual general meeting. April 20, *Coventry*, Annual general meeting and films; *Hatfield*, Discussion evening. April 21, *Southampton*, Nuclear Power Plants; *Yeovil*, "Carrier Operations (Wyvern)," by Lt-Cdr. C. E. Price. April 26, *Boscombe Down*, "The Light Fighter," by W. E. W. Petter. April 27, *Gloucester*, Annual general meeting and film show. April 28, *Yeovil*, Annual general meeting.

THE INDUSTRY

Inspection In Situ

PORTABLE X-ray equipment manufactured by a Danish firm, Carl Drenck of Copenhagen, has been adopted by a number of airlines for aircraft inspection work. One of the first users was Delta C & S Air Lines, who installed 175 kV equipment at their Atlanta, Georgia, base, and who have now replaced it by a 200 kV unit by the same makers. The new unit is of exactly the same size and weight but has a 50 per cent greater output. Other operators using these "Fedrex" units include Israel Airlines and Alitalia.

Made in 160, 175 and 200 kV sizes, the sets are easily lifted into position by hand, and are operated from a remote control panel via a 300-foot cable. The device is handled in this country by Inspection Equipment, 19 Broad Court, London, W.C.2.

New British Standards

NEW British Standards, published under the authority of the Aircraft Industry Standards Committee of the British Standards Institution, include the following: *D.C. Motors for Aircraft* (G.146:1955, price 3s 6d); *A.C. Motors for Aircraft, Part 1, Three-phase 400 c/s Squirrel-cage Induction Motors* (G. 147:1955, price 3s 6d); *55-Ton Low Alloy Steel for Aircraft* (B.S. 2S94:1955, price 1s); *Rivet Burrs for Aircraft* (S.B. 57 and 58:1955, price 1s).

Also issued by the Institution is a Standard of an unusual nature. Numbered B.S. 1311:1955 (price 2s 6d), and entitled *Sizes of Manufacturers' Trade and Technical Literature*, it has been prepared following requests from a number of trade organizations, chiefly in the engineering and building industries. Giving examples of reasons for establishing the new Standard, the B.S.I. says:

"Firstly, when large plant is installed, one aspect of the contractor's work is simplified if he can furnish full working instructions to his customer by assembling into one binder all the working instruction sheets issued by sub-contractors and suppliers of ancillary equipment. This is often not practicable unless all the literature is of the same size, and in any case a heterogeneous collection of sizes presents an untidy appearance that hardly constitutes a good advertisement.

"Secondly, with catalogues, brochures and pamphlets similar considerations arise. The psychological aspect of this is particularly important for exports, because sizes of literature have been standardized in many countries for years. In addition, even if there is no question of grouping with other publications, a great variety of shapes and sizes can become a considerable nuisance to librarians and others who wish to retain literature for reference."

All the above-mentioned Standards are obtainable, at the prices quoted, from the British Standards Institution Sales Branch at 2 Park Street, London, W.1.

IN BRIEF

Agence Aéronautique Legastelois of Cité Canrobert, 28-30 Rue Cambronne, Paris XV, announce that Miss R. M. Sharpe, M.B.E., late of W. S. Shackleton, Ltd., has joined them as pilot representative in charge of their light aircraft department.

* * *

Working in conjunction, the Regent Oil Co., Ltd., and the Atlas Diesel Co., Ltd., have recently developed a new hot-spray method for applying semi-solid anti-corrosive compounds. The former firm's Caltex rustproof compound L, and the latter's KV3 cup heater and Ecco 306 spray, are used in combination.

* * *

Following the appointment of Mr. V. M. G. Bennett as overseas liaison engineer of Teddington Controls, Ltd., Mr. S. Williams succeeds him in control of the London office, at 51 Brompton Road, S.W.3. Mr. Williams was until recently in charge of the company's London Airport office, where Mr. C. C. Hobson now takes over and will be responsible for liaison with operators and for London area servicing.

* * *

Capital Airlines have not only ordered Vickers-Armstrongs Viscounts, but have placed a substantial dollar order with another British company for some closely allied "aircraft"—actually, display models of the Viscount, made by Westway Models, Ltd., of Acton. Mr. Ian Walker, Westways' managing director, has just returned from a three weeks' visit to North America, where he was able to interest a number of domestic operators in sample models finished in their own liveries. He has also arranged with Plastics, Inc., of Ryan Avenue, St. Paul, Minn., to represent his company in the United States.

* * *

The aviation division of the Goodyear Tyre and Rubber Co., Ltd., at Wallasey, has won the G. K. Hinshaw Safety Trophy by completing the entire year of 1954 without a "lost time" accident. The trophy is awarded each year to the safest Goodyear factory outside the United States. Forty-nine of the company's plants in various parts of the world competed for the 1954 safety awards.

* * *

Some of the many applications of radio-frequency induction heating, including hardening, annealing, soldering, brazing and sintering, are dealt with in detail in a new brochure issued by Radio Heaters, Ltd., Eastheath Avenue, Wokingham, Berks. The booklet is illustrated with over a hundred photographs and diagrams, together with graphs from which capital and running costs can be estimated.

* * *

Articles in Issue No. 31 of *Wiggin Nickel Alloys* (Henry Wiggin and Co., Ltd., Birmingham 16) include a description of the assembly of Dunlop electro-thermal de-icing units, and another concerning the operation of the Graviner "Firewire" fire warning system. In the manufacture of the former, various high-nickel alloys are extensively employed; and, in the latter, use is made of the 18/20 nickel-chromium alloy Brightray C.

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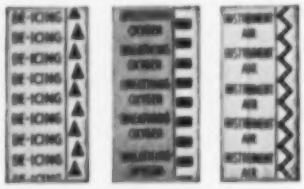

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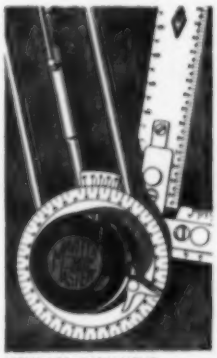

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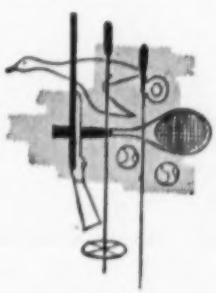

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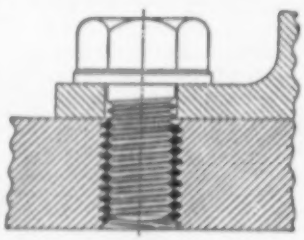

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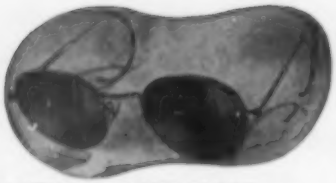

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APPLICATION No. 31/4. From Airwork Ltd., of 15, Chesterfield Street, London, W.1, for the inclusion of an optional traffic stop at Bermuda on their All Freight Services between London and Montreal and New York (Applications Nos. 31 and 32) approved by the Minister of Transport and Civil Aviation for operation during the period up to 31st May, 1963.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the day of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [3563

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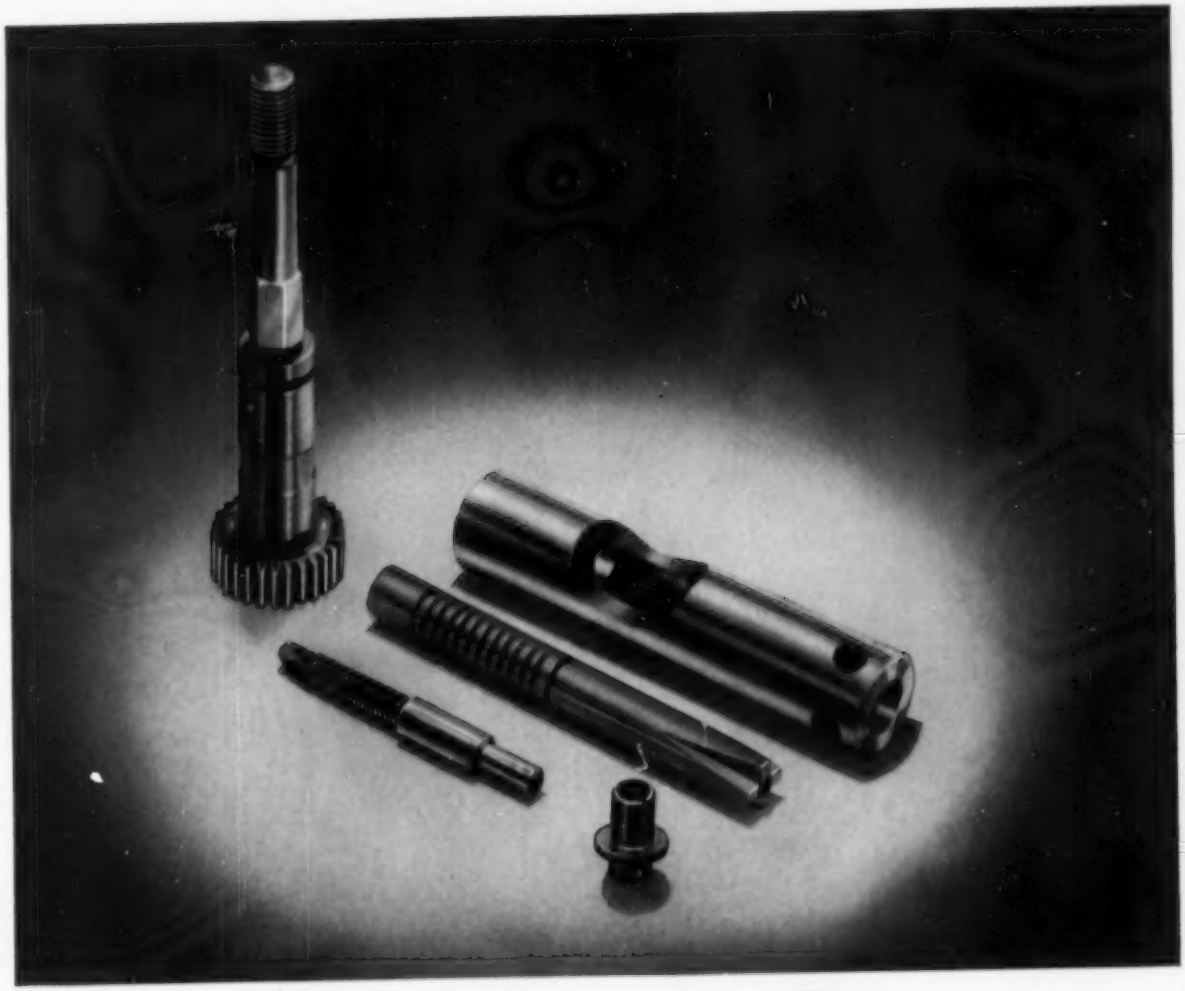

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